Final report

OWMC
Ontario
Waste Management
Corporation

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DILLON

SITE SELECTION PROCESS
PHASE 3B: SELECTION OF CANDIDATE SITES

Transportation

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31 October 1984

Ontario Waste Management Corporation
2 Bloor Street West
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Attention: Dr. B.D. Mitchell

OWMC Phase 3B Selection of
Candidate Sites - Transportation

Dear Sirs:

We are pleased to enclose our Final Report of the Site Selection Process Phase 3B: Selection of Candidate Sites - Transportation Report.

This documentation is part of the Site Selection Process of Phase 3B documentation and is in support of the Facilities Development Process Phase 3 Report and the Phase 3B Selection of Candidate Sites - Site Selection Report.

This report identifies the approach used, methodology developed and findings for transportation-related inputs to support the search process for the identification of candidate sites.

Yours truly,

M.M. DILLON LIMITED

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EXECUTIVE SUMMARY
PHASE 3B: SELECTION OF CANDIDATE SITES
TRANSPORTATION

1. PURPOSE

The purpose of the Site Selection Process Phase 3B-Selection of Candidate Sites Transportation Report is to assist the Ontario Waste Management Corporation (OWMC) in developing and applying transportation-related factors to the process of selecting candidate sites for special waste treatment facilities. Transportation is only one of several inputs considered in the site selection process which has led to the identification of a short list of candidate sites described in the Phase 3 Report: Facilities Development Process, March 1984, and the Phase 3B: Selection of Candidate Sites-Site Selection Report.

Phase 3 builds upon the findings of earlier Phases 1, 2 and Interim Phase 3 reports. These earlier reports, and subsequent analysis, led to the selection of 19 suitable candidate areas, plus the A-1 area added later, within the broad geographical region, around Lake Ontario between Oshawa and Niagara Falls. These areas had the best potential for safely supporting special waste treatment facilities of the size and type required. This report develops and applies new factors and refines transportation factors, originally considered in Phase 3A, which will assist in the systematic identification and selection of candidate sites from the 20 candidate areas (page 1).

This report concludes Phase 3. It also introduces the fourth phase which will apply new factors plus some refined Phase 3 factors to the eight candidate sites, in order to aid the Corporation in selecting the most appropriate one or two sites for the construction of the facilities.

2. SCOPE AND METHODS

Transportation-related inputs were prepared for Phase 3 to be used in the three-step site selection process. The three steps of this process are:

- identify site areas using constraint mapping;
- identify potential sites by screening site areas;
- identify candidate sites through initial comparative evaluation of potential sites.

Transportation factors were developed based upon the goals and objectives defined in the Phase 3 Report: Facilities Development Process (Pages: 7, 38, 79), and input from the public participation program (Page 101).

Each step in the process requires an increasing level of detail which results in a need to collect more refined data and introduce more site-specific factors (page 2).

2.1 IDENTIFY SITE AREAS

The transportation constraint mapping process produced 20 maps, contained in the Technical Data Map Portfolio, showing the location and controls imposed by airports, utility transmission lines, arterial roadways, and railway lines on the candidate areas. These data were compiled through topographic map interpretation and information obtained from various agencies responsible for the operation of these facilities, such as municipal/provincial/federal governments, oil/gas companies, Ontario Hydro, Bell Canada, and railway companies (pages 10, 14, 19, 23).

The site selection consultant and the consultant team selected appropriately scaled factors for use in the combined constraint mapping (page 5). The constraint mapping of the effect of airports on site locations was used in the combined constraint mapping (page 6). Regional information on relative transportation costs and accident probability was also used during this step (page 6). Following the combined constraint mapping, 152 site areas were identified to be included in the site area screening step (page 38).

2.2 IDENTIFY POTENTIAL SITES

The site area screening was carried out in two steps requiring an increasing level of detail for the data collected during constraint mapping (page 38). It also refined the two new factors; probability of transport accidents, and transport costs, which could be applied to compare the transportation attributes of sites from the assortment of site areas (page 39). The level of detail of information on arterial roads, railways, airports and utility transmission lines at this stage was more site area specific than that developed for constraint mapping (page 38).

The level of detail required that 90 of the 152 site areas be investigated in the field. In addition to the field work it was necessary to refine the transportation model to produce indicators of transport costs and the probability of transport accidents (page 48 and Appendix D).

The first step of the screening process examined the impact of factors such as railways, arterial roads, utility transmission lines, and airports at the 1:50 000 base map scale. This initial screening identified 90 of the 152 original site areas requiring further investigation (page 38). These remaining sites were investigated at the 1:10 000 base map scale, and reviewed through site visits (page 40).

The transportation model developed during the constraint mapping step was enhanced to; determine the best routes between source sites and receiver centroids, to calculate the tonne-kilometreage of special wastes that would be hauled to each receiver centroid, and the probability of transportation accidents along these routes (page 48). Inputs to this model included the Ontario highway network (page 55), the provincial average all-vehicle accident rates for each of the four different roadway classifications (page 57), the location of waste sources (page 49), the quantity of wastes produced at each waste source (page 50), and the locations of cluster receiver centroids which would represent groups or clusters of site areas in close proximity (page 53). By comparing the transport costs and accident probabilities for each cluster centroid, it was possible to identify those areas with the minimum transportation cost (page 61) and accident probability (page 63).

The results of the cost and accident analyses, and the field and office investigations (page 67) were used in conjunction with the factor inputs provided by other consultants to screen site areas and determine which potential sites were suitable for inclusion in the initial comparative evaluation step, and which sites could be combined to produce site options.

2.3 IDENTIFY CANDIDATE SITES

Following the selection of the potential site options, transportation comparative evaluation factors were developed and applied to produce a ranking of the potential site options. The activities in this step included analysis of alternate site access routes, refinement of site screening factors, and further enhancement of the model outputs for application in comparative evaluation (page 75, 76).

The access route analysis investigated the transportation safety of local and regional routes which could be used to reach the site from the freeway. The indicators considered for local access included proximity to arterial roads, and the number of local railway crossings. The regional road's transportation safety was compared on the basis of the possibility of an accident, distance to freeway, number of level railway crossings, number of intersections where a turn is required, and the haul distance between PI and LF site combinations. The findings of the transportation analysis and the analyses carried out by the other disciplines were used to select the best route for accessing the site (page 83, Appendix G).

The site field and office investigations conducted during the site area screening step produced a number of factor refinements which were applied on a site-by-site basis in the comparative evaluation. These factors included; proximity to railways, proximity to arterial roads and freeways, height restrictions near Transport Canada controlled airports, the implications of road closures and the condition of local access roads, and local utility relocation requirements (page 77 and 78).

The transport cost and transport accident indicators developed earlier in the process were modified to provide information on a site-specific basis, rather than by cluster centroid. These modifications included the haulage of additives to certain potential sites, transport of treated wastes from physical chemical/incinerator sites to selected landfill sites, and the transposition of the cluster centroid cost and accident indicators to each of the potential sites near the centroid (page 80 and 91).

The comparative evaluation produced a ranking of the potential sites in terms of their transportation requirements (page 115). This provided input to the task of selecting candidate sites.

3. PREMISES AND POSTULATES

3.1 PREMISES

a) The quantity of special wastes, classified by 14 categories, to be transported to OWMC treatment facilities was provided by OWMC (reference 5) and totalled 150 000 tonnes per annum (page 50).

b) The smoke stack height for the incinerator facility was identified by OWMC to have a maximum height of 100 m (page 18).

3.2 POSTULATES

a) Process additive quantities required at the OWMC physical/chemical treatment facility, and used for the solidification of treated special wastes prior to landfilling, were obtained from previous studies. The cement-only process for total solidification of the process effluent at a 0.3:1 ratio would require 7700 tonnes/annum of cement (Appendix I, page 90).

b) Non-integrated OWMC treatment and disposal facilities require that treated special wastes be transported from the physical chemical/incinerator facility to the selected landfill disposal site. Based upon the assumed 150 000 tonnes/annum of special wastes processed and 7700 tonnes/annum of additives, previous study (Appendix I) indicates that 124 200 tonnes/annum of treated residue would be involved in this transfer (page 91).

c) For purposes of screening and initial comparative evaluation of sites, the truck transport mode was selected for the haulage of special wastes and additives. Although rail haulage of these materials, particularly additives and reagents required at the OWMC treatment facilities, could prove to be more cost-effective, only the road transport mode was considered at this time (page 1).

d) The combination of distance travelled and quantity carried produced the tonne-kilometres of haulage from special waste and additive source sites to potential treatment sites. This was used to represent the transportation costs incurred at each site (page 61).

e) The distribution of wastes to each municipal source was based on the report by Pilorosso et al. (reference 4) (page 50).

f) The source of cement additives for all potential receiver sites was assumed to be the Ingersoll area since it is the most centrally located of all cement producing sources in the region (page 92).

g) The opening date of OWMC facilities, for purposes of identifying arterial roads which will be available to serve the site, was assumed to be 1988 (page 23).

h) The Ontario five-year provincial average all-vehicle accident rate was used in calculating the value to represent transportation accidents for the four different roadway classifications (page 59).

i) The maximum height of buildings at the OWMC physical/chemical treatment and landfill sites was assumed to be 30 m and 20 m respectively, based on analysis by the OWMC facility consultants (page 16).

j) The municipal areas in which special wastes are produced was represented by a single waste source point. This point was assumed to be centrally located, easily accessible along arterial routes and within an area of high population density and/or industrial development density (pages 48, D-8 and D-9).

4. STATUS OF DATA

The information used to develop the transportation factors was gathered initially from secondary source maps, and cross-checked through personal contact with governmental agenices, utility owners, and site area field reconnaissance where possible. This largely applies to the existing location of utility transmission lines, railways, arterial roads, airports and related factors.

Some information gathered from outside agencies could not be verified, but considering its source it was not deemed necessary to cross-check the information. Such information includes zoning restrictions on building heights in the vicinity of Transport Canada airports (page 45), average provincial vehicular accident rates (page 59), the source and quantity of special wastes (page 49, 50), reagents and additives (page 90), facility configuration and proposed improvements to the existing provincial highway network (page 23 and Appendix D).

During constraint mapping, information was abstracted from recent 1:50 000 scale maps and cross-checked through agency contacts. This information dealt largely with the physical location of possible site area constraints or opportunities, such as arterial roads, railways, utility transmission lines and airports. Only the mapping of airports and their area of influence was used to select site areas because this provided a navigation height area constraint which could eliminate sections of candidate areas. The information collected on the other three factors indicated that these were linear constraints which should be applied at the site screening level (page 5).

The information gathered during site area screening gave more detail on locating constraints and aided the development of the transportation model. Information on the location of railways, airports, arterial roads, local utilities and major transmission lines was recorded on 1:10 000 scale base maps, and field and office data forms. This information was verified by field reconnaissance (page 37).

The information input to the transportation model during site area screening was obtained through the Ministry of Transportation and Communications (MTC), and previous studies. The MTC information included the classification and length of each road in the Ontario highway network (page 54), proposed highway improvements (page 23), and the average accident rates (page 59) and speeds for each road classification. The information was reliable and up-to-date, therefore no cross-checking was undertaken. Other information gathered for the model, such as the source and quantity of waste operation, was obtained from previous studies and reports (reference 4).

Most of the information developed and used during the initial comparative evaluation step had been collected earlier; however some additional agency contacts were required. The field reconnaissance, carried out during the site screening process, collected and verified information which would be used during the initial comparative evaluation step. The evaluation of the impact of airports on potential sites required additional input from Transport Canada in relation to the two airports under their control, as well as the probable air navigational effects at other airports in the vicinity of sites (page 98).

During the remaining phases of the Facility Development Process, more detailed information will be secured and applied which could influence the mode of transport or method of risk analysis, and permit the refinement of transport costs and annual accident frequencies in relation to OWMC facility operations. At such time that this new information is introduced, the findings of this phase will be re-examined in order to discover what effects, if any, this new data will have on the candidate sites selected (page 117).

5. MAIN FINDINGS

5.1 IDENTIFICATION OF SITE AREAS: CONSTRAINT MAPPING

Not all of the transportation factors identified for constraint mapping were used in the identification of site areas (page 5). The impact of airports on candidate areas was one transportation factor considered in the identification of sites areas because this transportation factor had an area influence (page 6) in relation to the airport facilities. The only other transportation factor applied at this stage was the combination of transport costs and accident probability indices on a regional basis. Although this factor was not used to eliminate candidate areas, it provided data for comparing the relative transportation attributes of different candidate areas (page 6). The information collected on other factors at this step was later used in the identification of potential sites (page 38).

The full impact of the two Transport Canada airports was not completely assessed at this stage and further contacts with Transport Canada during the screening and comparative evaluation steps revealed the more substantial effect of this factor in relation to sites in proximity to these two airports (page 17).

The regional analysis of the transport costs and accidents indicated that candidate site areas north of Lake Ontario have less costs and risks than those west of the lake, and are much better, in a transport cost and risk sense, than those in the Niagara area (page 32 and 34).

5.2 IDENTIFICATION OF POTENTIAL SITES: SITE AREA SCREENING

The linear affect of such factors as major transmission lines, railways and arterial roads, as well as the impact of airports, and to a lesser degree, transportation cost and accident frequency indices for receiver site centroids influenced the selection of potential sites. The linear factors were primarily used to define site boundaries, the cost and accident indices were used to compare the effects of locating sites in one area as opposed to another (page 38).

The transportation model developed during Phase 3 was sensitive to a number of items but the degree of sensitivity was not investigated at this time. The model is sensitive to changes in the Ontario highway network, location of the source points for process additives, reagents, and the quantity of special wastes produced at each source site. To minimize sensitivity, the output from the model was applied only for comparing one site to another (page 60).

The ranking of the 90 site areas remaining after the initial screening, in terms of their transportation attributes and constraints, was based largely on the constraints imposed in the vicinity of the site area itself (page 70). The combined accident probability and transport cost index was used to a lesser extent to highlight the regional differences that exist between groups of site areas. However, when the transportation factors were combined with factors from other disciplines the regional accident probability index was used to rank site areas because it was the best indicator of transportation safety (page 72).

5.3 IDENTIFICATION OF CANDIDATE SITES: INITIAL COMPARATIVE EVALUATION

The initial comparative evaluations step ranked the 17 potential site combinations remaining from the site screening step, according to the intensity of the constraints imposed at each level of transportation factor applications (i.e. site, site vicinity and regional access) (page 110). From a transportaton viewpoint, regional access constraints are the most difficult to mitigate, therefore, sites with low constraints at this level are the most favourable (page 114). However, the constraints imposed at the other factor levels are also important but to a lesser degree.

The report identified two potential site options as having the "most suitable" (for definition, see pages 112 and 115) overall transportation attributes:

- LF-4N
- LF-1N/LF-4N

The report identified six potential site options as being "moderately suitable" (for definition, see page 115) in terms of transportation attributes based on the information available at this time:

- PI-13N/LF-4N
- PI-13N/LF-2N
- PI-1N/LF-2N
- PI-1A1/LF-2N
- LF-10W
- LF-11W

The report also identified seven siting options which, should the railway mode be identified as a supportive or alternative transport mode, would improve their overall transportation attributes (page 117):

- LF-3C
- LF-3E
- LF-8C
- LF-9C
- PI-27E/LF-1E
- LF-1E
- LF-18E/LF-1C

The two remaining siting options were identified as having the "least suitable" (for definition, see pages 115 and 117) transportation attributes, and no rail opportunities:

- PI-2W/LF-11W
- PI-2W/LF-10W

Although some of these site options have the best potential overall transport attributes, their selection as a candidate site will depend on the combined affect of all the factors from all the disciplines involved in the site selection process (page 110).

6. CONCLUSIONS AND RECOMMENDATIONS

The application of transportation factors at each step of the site selection process has lead to the ranking of potential site options in terms of transportation constraints and opportunities.

It should be stressed that transportation factors alone do not determine the selection of a site. Transportation factors themselves do not consider such other factors as socio-economic, natural environment, land use, and agriculture, which also were crucial to the site selection process (page 110). However, transportation factor ranking can be compared with the rankings derived for these other factors to identify sites with the best overall benefits and opportunities.

Two of the factors developed in the ranking of the potential sites (transportation costs and accident frequency) are dependent upon other information such as, facility processes, quantities of waste, reagents and additives, mode of transport, and the characteristics of the routes used (page 89 and 92). During Phase 3 a number of assumptions were made regarding these features because some aspects have not as yet been determined (page 76).

It is recommended that during Phase 4 that all assumptions be reviewed and updated to reflect future decisions taken by the Corporation (page 76, 117).

CHAPTER 1

INTRODUCTION

Many of Ontario's highway transportation facilities are important in the selection of a suitable site for the OWMC's hazardous waste treatment plant and landfill. This report's analysis of Ontario's transportation networks considers both the safe, efficient transportation of waste (including treatment additives) to the treatment site, and also the constraints that are imposed on site size and location by the existing and proposed location of a transportation mode's infrastructure. Although road transportation is the only mode considered in this analysis for the transportation of wastes, rail transport is not precluded. The physical components of utility transmission, air, rail and road transport modes are also considered in the selection of suitable sites.

The site selection process used in Phase 3 is composed of three steps:

1. Identification of Site Areas Using Constraint Mapping
2. Identification of Potential Sites Using Site Area Screening
3. Identification of Candidate Sites Using Initial Comparative Evaluation

A number of factors, developed by a variety of disciplines, are applied separately at each step in the process. The 20 candidate areas, 19 identified in the Phase 3 Interim Report and one additional area added later, were systematically reduced to site areas, potential and candidate sites through the combined influence of the factors developed by all disciplines using constraint mapping, site area screening and initial comparative evaluation steps. This report documents only the transportation discipline's inputs to each of the three steps in the site selection process.

The synthesis of all the inputs provided by the various consulting disciplines is documented in the Site Selection Report prepared by the site selection team.

To reflect the application of the site selection process, this report has been divided into three parts:

Part I: Identification of Site Areas
(Constraint Mapping)

Part II: Identification of Potential Sites
(Site Area Screening)

Part III: Identification of Candidate Sites
(Initial Comparative Evaluation)

Each of these parts describes the development and application of the transportation factors used at each step of the process. The identification of site areas portion deals largely with the macroscopic physical components of transportation which may constrain the size and location of site areas as well as the influence of transport costs and accidents on a regional level. Identification of potential sites provides a more detailed examination of the physical components and introduces transport cost and accident indices on a more detailed level than previously. The final portion of the report examines the transportation requirements associated with each of the potential sites previously identified through the site area screening.

Part I is comprised of Chapters 2 to 7 which discuss the development of the six transportation constraint mapping factors. The six factors which affect candidate areas are airports, railways, arterial roads, transmission lines, regional transport costs and accident probability. The results of this mapping process are shown on the 16 constraint maps contained in the Technical Data Map Portfolio accompanying this report, and on maps within the text of the report.

Part II, Chapters 8 to 14, documents the four constraint mapping factors as refined through field reconnaissance, and the enhancement of transportation cost and accident probability factors for the screening of site areas. The results of the screening are presented in matrix form in Appendix E of this report.

Part III which includes Chapters 15 through 21 describes the development of the nine factors and their application to the initial comparative evaluation of potential sites identified in the site screening step. The results of the comparison are presented in table form in the report, and a number of sites are identified as suitable for candidate sites from a transportation viewpoint.

PART I
IDENTIFICATION OF SITE AREAS
(CONSTRAINT MAPPING)

CHAPTER 2
INTRODUCTION

Earlier phases of the OWMC facility development process have narrowed the search for a suitable site to the geographical region west of Lake Ontario from Oshawa to Niagara Falls. Following the Interim Phase 3 Report and subsequent analyses, 20 candidate areas within this region were found to meet the primary requirements for supporting hazardous waste facilities. The objective of the constraint mapping step is to identify a number of site areas within the twenty candidate areas which provide the best characteristics for supporting a site.

This portion of the report presents the transportation factors which were introduced during the constraint mapping step. There is no discussion regarding which site areas were selected during this step since this is dependent on the input of many other disciplinary factors which are not within the scope of this report. However, the report does comment on how each of the transportation factors was applied in the constraint mapping step. The site areas carried into the site area screening are identified in Part II of this report.

The synthesis of all the various consultant inputs used in the identification of site areas is contained in the Site Selection Report prepared by the site selection team.

There are six transportation factors developed for constraint mapping: utility transmission lines, arterial roadways, railways, airports, transport costs and accident probability. Of these six factors only the latter three factors were included in the site selection process at this step. The other factors were not used because they were linear constraints which could not eliminate areas. The mapping of the linear factors was used in the site area screening step.

The first factor, transmission lines, includes the major carriers of: electric power, oil and gas, sewer and water, and telephone signals. All these installations are considered to be a constraint to an area's size and configuration. The only possible opportunity is to use these corridors as buffer zones between the OWMC facility and adjacent land uses.

Arterial roadways, expected to carry the largest share of Ontario's special wastes, is the second factor under consideration. An area's accessibility to major arterials, including provincial highways, is considered an essential service. Areas located adjacent to arterial roadways will require less access roadway construction, and their proximity to major vehicle-moving facilities, such as 400-series highways, can minimize transportation costs and accident risks. However, sites which straddle major roadways will be constrained since these roadways cannot be closed.

The third factor, railway lines, is also a constraint and an opportunity. When a rail line flanks a candidate area it can enhance the area's accessibility, however an area which straddles a rail line may be severely limited in site size. Abandoned rail lines can benefit a site area if they are developed as industrial spur lines to connect to national rail lines.

Airports are considered a constraint since building in their environment is governed closely by Transport Canada regulations. Some airports (Lester B. Pearson and Hamilton Civic) can legally prohibit the construction of vertical obstructions within a 4000 m circle of the airport or along the projection of runways - these restrictions may constrain a site's incinerator stack height. Other airfields have similar requirements and, although they do not legally prohibit obstructions in their vicinity, such obstructions may adversely affect the licensing of these airfields.

The affect of all these components on areas is mapped and illustrated on the 16 maps contained in the Technical Data Map Portfolio accompanying this report. There is a separate constraint map for each of the four factors and for each of the four regions containing the 20 candidate areas.

Transportation costs and accident probability are factors which were applied on a regional basis in order to obtain a coarse representation of good, moderate and poor relative transportation opportunities. Regions of better transportation opportunities are likely to have lower accident probabilities and lower transport costs. These regions are illustrated in Part 2 of this report.

Appendix A contains the factor sheets for identifying site areas which explain the rational for chosing these transportation factors, how they affect site selection, and the research undertaken in factor development.

CHAPTER 3

OVERVIEW

The transportation factors applied during constraint mapping were developed giving recognition to the goals and objectives of Phase 3. The three main goals of Phase 3 in order of priority are as follows:

I. Minimize Risk to Human Health
II. Minimize Environmental Impacts
III. Minimize Financial Cost to OWMC

There are a number of objectives for each of these goals which can be met by the application of various transportation factors. The full list of Phase 3 goals and objectives is contained in the Appendix to the Facilities Development Process - Phase 3 Report, issued March 1984.

In minimizing risks to human health, the following objective relates to constraint mapping transportation factors:

1. To select transportation routes and modes which minimize the likelihood of a release of contaminants during transit.

The transportation model and its application to the calculation of accident probability for various sub-regions, represented by receiver centroids, was developed to meet this objective. The model selects routes which minimize travel time and travel distances by maximizing the use of 400-series highways. The accident rate on the site access roads is an indicator of the possibility of a spill. By maximizing the use of 400-series highways, and other routes which avoid populated areas, the number of people who might be exposed to a spill is minimized.

The second goal, minimization of environmental impacts, can be attained through these two transportation-related objectives:

1. To minimize conflicts with Federal, Provincial, municipal, and native community policies, programs and plans.

2. To minimize adverse effects upon the provision and use of public and private community services and facilities.

The examination of possible conflicts between the siting of the facilities and an airport in the vicinity was developed to address both objectives. Federal policies regarding building near federally controlled airports are respected during site selection so that no conflicts occur. The effects that the facilities will have on other, non-federally controlled airports is also examined to minimize the site's impact on those facilities.

The development of factors such as: transmission lines, roadways or rail lines was carried out in order to minimize effects on community services.

The final goal, minimize financial cost to OWMC, contains three transportation-related objectives:

1. To minimize on-site development costs.

2. To minimize off-site development costs.

3. To minimize transportation operation costs associated with hauling.

The factors dealing with the location and characteristics of transmission lines, railways and roads were developed to address the first objective. On-site costs can be minimized if the removal or rerouting of these components is minimized.

Similarly, off-site costs can be reduced when site access costs are minimized. This objective is achieved by examining the availability of major arterial roads and freeways to site areas and minimizing the use of local roads which require upgrading.

Regional transportation operating costs were determined during site area screening by calculating the estimated tonne-kilometres of waste transported annually to the receiver centroid from all source points. Since transportation costs are dependent upon the tonnes of wastes hauled and the distance of haulage, transport costs will be lowest for the general site area with the smallest annual tonne-kilometres of waste haulage.

Each of the objectives discussed in this section are also met by the more detailed factors applied in the screening of site areas.

CHAPTER 4
MAPPING OF TRANSMISSION LINES

Major cross-country transmission lines pose a constraint to a site's size and configuration. Such major installations include, Ontario Hydro power lines, oil and gas pipelines, trunk sewer and water systems, and Bell Canada Telephone cables. The locations of all these installations were researched and mapped onto 1:50 000 scale plans for input to the site selection process.

It is recommended that OWMC waste treatment sites should not conflict with existing transmission line installations because there is a substantial cost associated with their removal and relocation, and interconnection possibilities for on-site use are very limited. The mapping of the transmission lines with respect to candidate areas is presented on the plans accompanying this report. However, these maps were not used by the site selection consultant in the composite constraint mapping of the site selection process; instead they were applied during the identification of potential sites.

1. SOURCES OF INFORMATION

Information on the location of transmission line facilities was compiled from available mapping, and data supplied by the Ontario Energy Board, individual companies, and municipalities.
Initially, OWMC's base map series (derived from the Department of Energy, Mines and Resources 1:50 000 scale topographic mapping) was used to locate existing oil and gas pipelines, and major hydro transmission lines. The Ontario Energy Board then identified the specific oil and gas companies to whom these facilities belonged.

These oil and gas companies, as well as Ontario Hydro, Bell Canada and specific municipalities were all contacted by telephone and/or mail and given a map on which to plot the locations of their installations.

It was then necessary to record and verify the information supplied by the transmission line owners. The information was correlated with the original information displayed on the 1:50 000 scale maps and then companies/municipalities were visited to confirm the location and type of facilities on these maps.

The following is a listing of companies/agencies/ municipalities contacted in collecting data on transmission line installations.

- Ontario Hydro
- Bell Canada
- Region of Niagara
- Region of Hamilton-Wentworth
- Region of Peel
- Region of Halton
- Ministry of the Environment
    - . Central Region (Halton-Peel District)
    - . Southwest Region (Hamilton)
- Consumers Gas
- Union Gas
- TransCanada Pipelines (TCPL)
- InterProvincial Pipelines (IPLL)
- Sun Canadian (SCPL)
- TransNorthern Pipelines (TNPL)

2. TRANSMISSION LINE MAPPING

All information on facility locations was plotted on overlays to the OWMC's 1:50 000 scale base map series. The following maps, included in the Technical Data Map Portfolio illustrate the mapping of gas and oil pipelines, hydro lines, Bell Canada cable routings, and trunk sewer lines for the regions of candidate areas.

Map No.	Description
DT-1	Transmission lines in the Northern and A1 Regions
DT-2	Transmission lines in the Western Region
DT-3	Transmission lines in the Central Region
DT-4	Transmission lines in the Eastern Region

3. CRITERIA FOR IDENTIFYING SITE AREAS

Transmission lines pose a linear constraint on the size, siting and orientation of OWMC facilities, and are therefore more suitable for site screening than constraint mapping. In general, when selecting sites these major transmission line installations should be avoided wherever possible. Furthermore, proximity to such installations is not necessarily an advantage, since direct connection to these facilities for site servicing is not possible in most instances. However, a transmission line corridor adjacent to an OWMC facility could act as part of a buffer zone between the OWMC facilities and other adjacent sensitive land uses.

Potential conflicts with transmission lines may be overcome in certain cases by their relocation. However, the logistics and cost for such relocations may be prohibitive, particularly for high voltage lines, telephone trunk cables and some high pressure oil and gas pipelines.

CHAPTER 5
MAPPING OF AIRPORT FACILITIES

The environment around an airport is regulated by Transport Canada to ensure that no obstructions interfere with the airport's safe operation. This regulated environment is known as the airport's obstacle control protection area. This chapter discusses how these areas are calculated and mapped with respect to the locations of candidate areas.

Since airports have no site-servicing advantages, and in most cases airport relocation is not feasible, it is recommended that site areas should not conflict with restrictions imposed by either an airport's obstacle control protection area or Transport Canada's recommendations. Such restrictive areas are shown on the maps accompanying this report and were also used in the composite constraint mapping process.

1. SOURCES OF INFORMATION

The airport locations were determined from three sources:

i) 1981/82 Ontario Air Facilities Map, Ministry of Transportation and Communications;
ii) 1983 VFR Supplement, Transport Canada;
iii) 1982 Ontario Airstrip Charts, The Ontario Flying Farmers.

The obstacle limitation surfaces were plotted according to control data published by the Aeronautical Standards and Legislation Branch of the Ministry of Transport (reference 1).

2. OBSTACLE CONTROL PROTECTION

The obstacle control protection area is the environment around an airport in which height restrictions have been established for the protection of aircraft conducting circling procedures or take-off/landing manoeuvres. The two obstacle limitation surfaces shown in Figure I-1 constitute the obstacle control protection area and are defined as:

> Outer Surface - A specified portion of a plane located above an aerodrome and its immediate environment. This surface establishes the height above which it may be necessary to take one or more of the following actions; restrict the erection of new structures which would constitute an obstruction, remove or mark obstacles to ensure a satisfactory level of safety and regularity for aircraft manoeuvring visually in the vicinity of the airport before commencing the final approach phase (reference 2).
>
> Transitional Surface - A complex surface along the side of the air strip and part of the side of the approach surface, that slopes up to the outer surface. Transitional surfaces shall be established for each runway direction intended to be used for the take-off or landing of aeroplanes. The purpose of a transitional surface is to ensure a satisfactory level of safety for aeroplanes flying at low altitude and displaced from the runway centre line in the approach or missed approach phase (reference 3).

The outer surface control prohibits vertical obstructions exceeding 45 m (150 ft.) within a radius of 4 000 m (13 000 ft.) from the theoretical reference point(s) at each airport. The reference point(s) is(are) located as near as practical to the geometric centre of individual landing areas with an adjustment for future development. The outer surface control would influence the location of the incinerator facility since the stack height is assumed to be greater than 45 m.

Within the 4000 m radius, the more restrictive transitional surface controls exist. These are oriented with respect to the individual runways and are most restrictive off the runway ends as opposed to the runways longitudinal edges. The transitional surface controls were calculated and mapped for an assumed 30 m (100 ft.) height physical/chemical treatment facility and a 20 m (65 ft.) height solidification/landfill site development. The transitional control surfaces were not calculated when the runway layout could not be determined from the information sources.

The spatial effect of these two components of the obstacle control protection area is illustrated from a perspective view in Figure I-2 and in plan view in Figure I-3. The transitional surface is shown in cross section in Figure I-4.

Only certain airports can legally prohibit infringements in their control areas. In the mapped suitable site areas, such obstacle control protection exists only at Lester B. Pearson International Airport (Toronto), and Hamilton Civic Airport. All other airports located within the mapped coverage of the candidate areas do not enjoy this restrictive protection. However, infringement within their theoretical control areas could adversely affect their licencing or their operation and thus would impact their present use. Contact with Transport Canada officials is required to secure an interpretation of probable effects resulting from an infringement within the control surfaces of other airports.

3. AIRPORT MAPPING

The obstacle control protection areas were plotted on overlays to the OWMC 1:50 000 base map series for those airports near

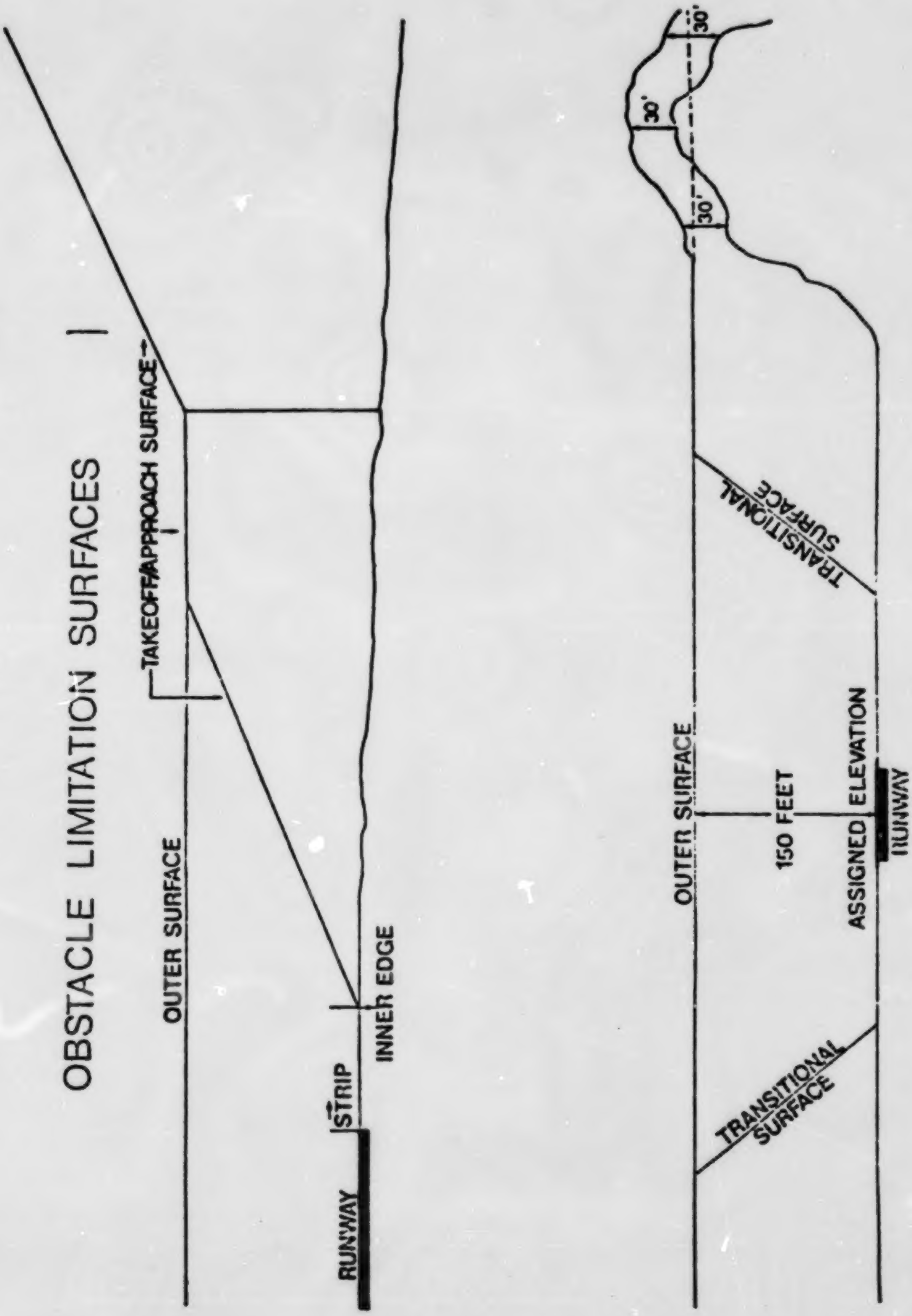
OBSTACLE LIMITATION SURFACES
TAKEOFF/APPROACH SURFACE
OUTER SURFACE
INNER EDGE
STRIP
RUNWAY
30'
30'
30'
TRANSITIONAL SURFACE
OUTER SURFACE
150 FEET
ASSIGNED ELEVATION
RUNWAY
TRANSITIONAL SURFACE

FIGURE I-1:
OBSTACLE LIMITATION SURFACES

SOURCE: REFERENCE 1

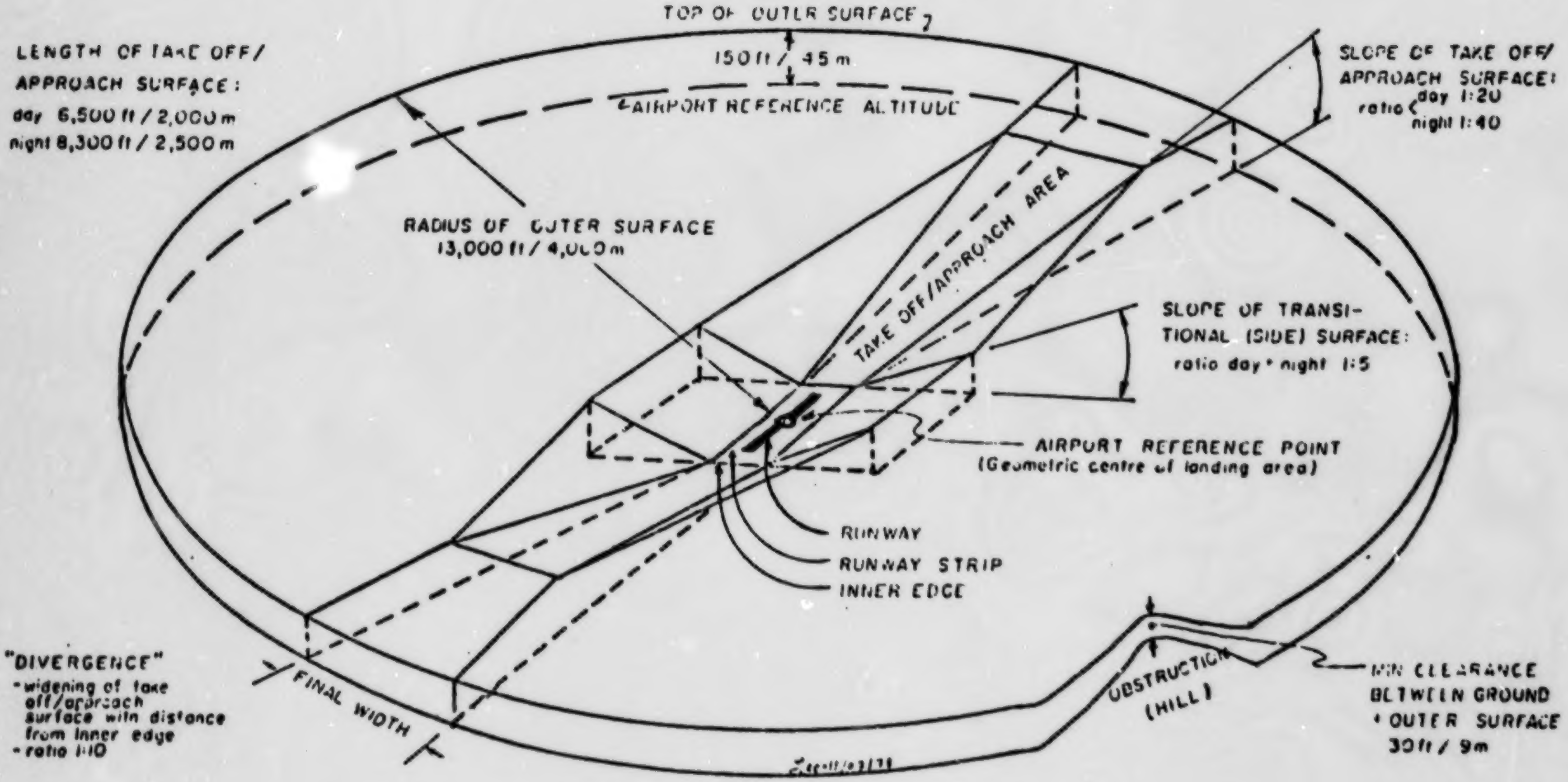
TOP OF OUTER SURFACE
150 ft / 45 m
AIRPORT REFERENCE ALTITUDE
LENGTH OF TAKE OFF/ APPROACH SURFACE: day 6,500 ft / 2,000 m night 8,300 ft / 2,500 m
SLOPE OF TAKE OFF/ APPROACH SURFACE: ratio day 1:20 night 1:40
RADIUS OF OUTER SURFACE 13,000 ft / 4,000 m
TAKE OFF/APPROACH AREA
SLOPE OF TRANSI- TIONAL (SIDE) SURFACE: ratio day + night 1:5
AIRPORT REFERENCE POINT (Geometric centre of landing area)
RUNWAY
RUNWAY STRIP
INNER EDGE
"DIVERGENCE" - widening of take off/approach surface with distance from inner edge - ratio 1:10
FINAL WIDTH
OBSTRUCTION (HILL)
MIN CLEARANCE BETWEEN GROUND + OUTER SURFACE 30 ft / 9 m

FIGURE I-2:
OBSTACLE CONTROL PROTECTION AREA IN PERSPECTIVE VIEW

SOURCE: REFERENCE 1

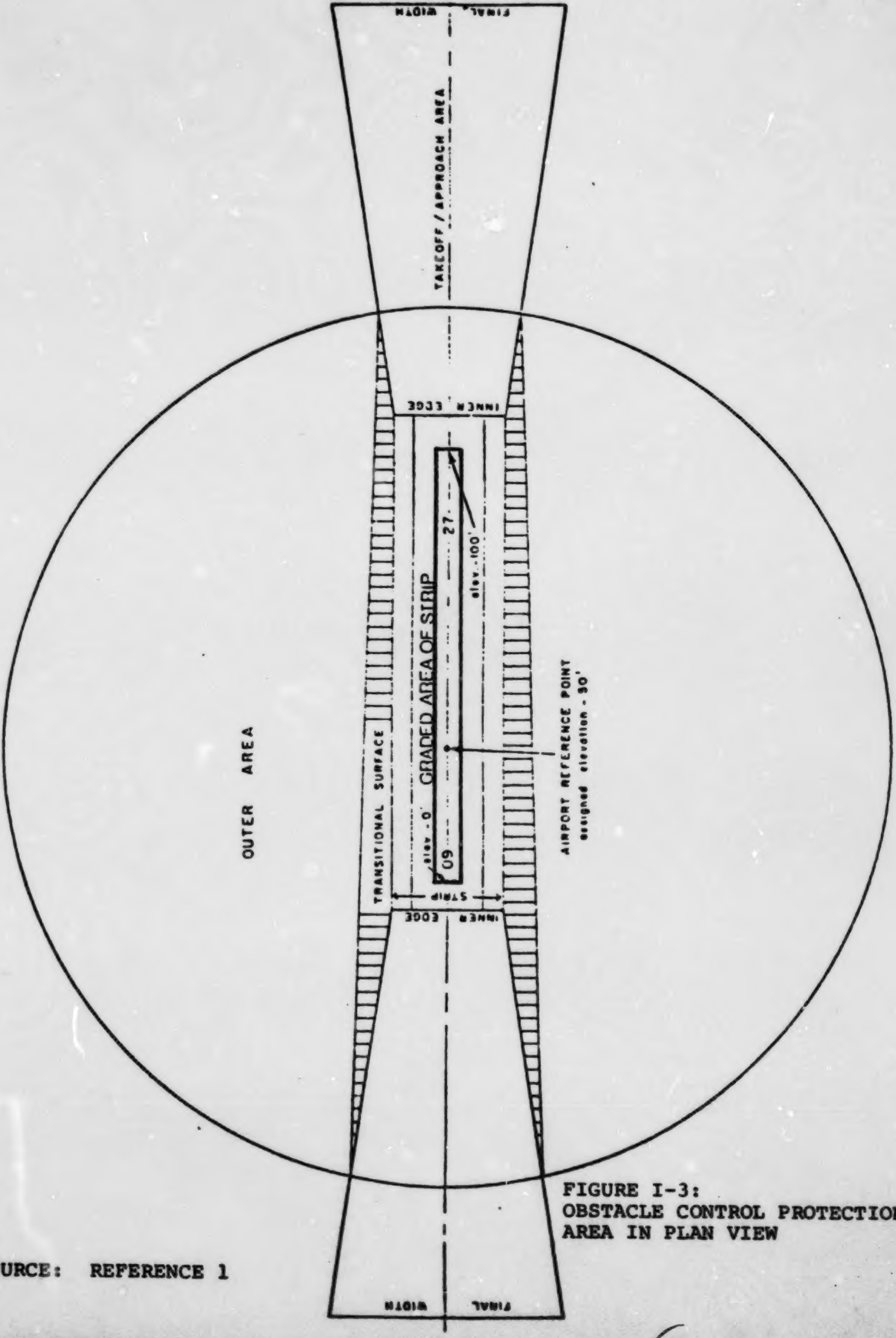
FINAL WIDTH
TAKEOFF / APPROACH AREA
INNER EDGE
OUTER AREA
TRANSITIONAL SURFACE
GRADED AREA OF STRIP
27
elev. 100'
09
elev. 0'
AIRPORT REFERENCE POINT
assigned elevation - 50'
STRIP
INNER EDGE
FINAL WIDTH

FIGURE I-3:
OBSTACLE CONTROL PROTECTION
AREA IN PLAN VIEW

SOURCE: REFERENCE 1

RUNWAY STRIP CHARACTERISTICS

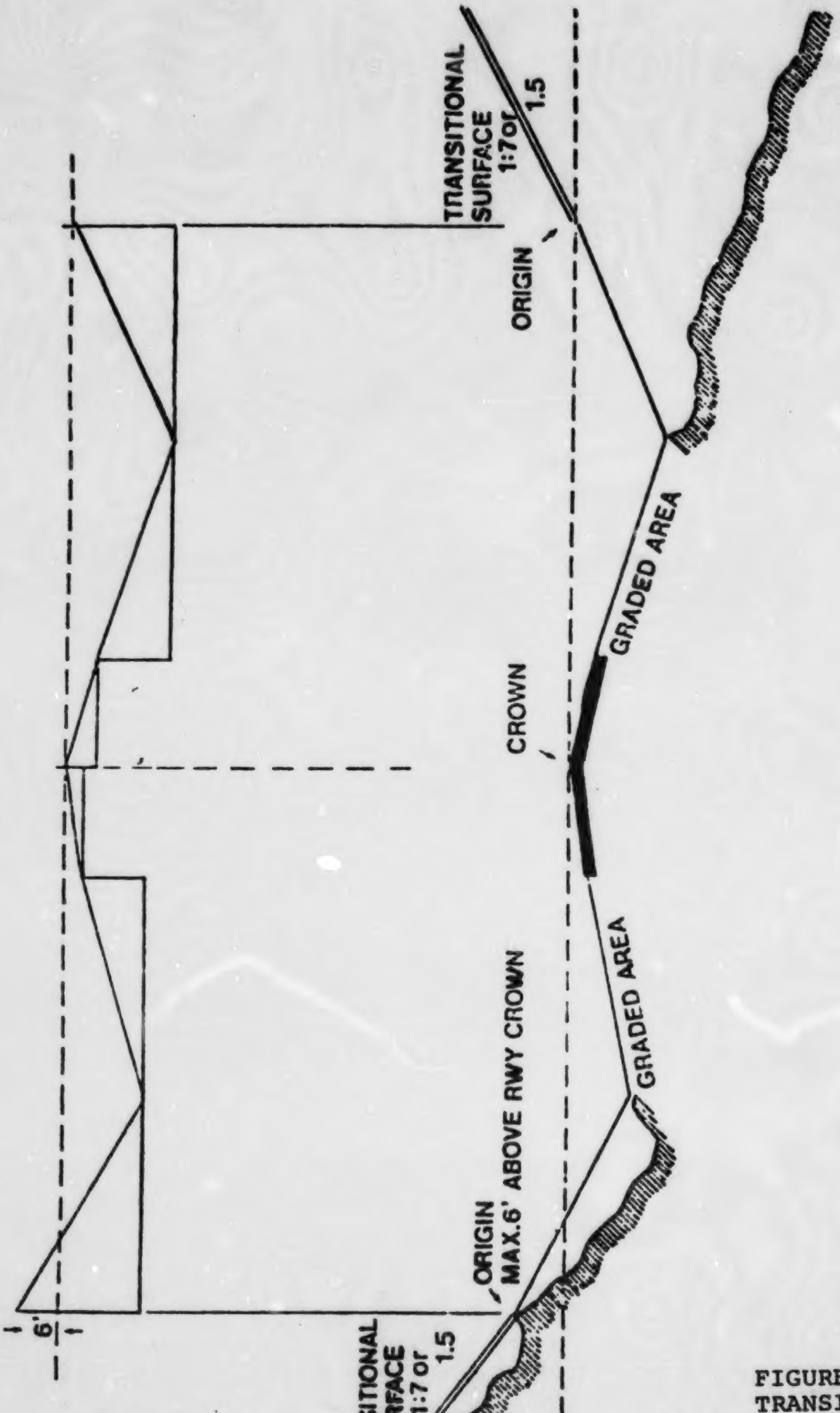
6'
TRANSITIONAL SURFACE 1:7 or 1.5
ORIGIN MAX.6' ABOVE RWY CROWN
GRADED AREA
CROWN
GRADED AREA
ORIGIN
TRANSITIONAL SURFACE 1:7or 1.5

FIGURE I-4: TRANSITIONAL SURFACE

SOURCE: REFERENCE 1

candidate areas. All calculations were undertaken as described in the Aerodrome Standards publication of Transport Canada. Distinct legends were used to distinguish the two controlled airports from those having no formal control.

The following maps are included in the Technical Data Map Portfolio and illustrate the airport constraints that are used in constraint mapping.

Map No.	Description
DT-5	Airports in the Northern and A1 Regions
DT-6	Airports in the Western Region
DT-7	Airports in the Central Region
DT-8	Airports in the Eastern Region

4. CRITERIA FOR IDENTIFYING SITE AREAS

At the controlled airports, Lester B. Pearson International and Hamilton Civic, the obstacle limitation controls plotted are exclusionary. For all other airports identified, the controls are considered to be constraints since they could affect licensing or operations. It should be noted that all control surfaces identified are subject to adjustment and/or interpretation by Transport Canada officials.

The mapping of major public and private airport boundaries was used in the composite constraint mapping to select suitable site areas for screening. These airports included Welland-Port Colborne Airport, Burlington Airpark, and York Airfield.

The airports' areas of influence, which were mapped during constraint mapping, were used to identify areas where a certain height of object would be prohibited due to its effect on airport operations. When applying these restrictions to the waste treatment facilities, it is noted that the height of the facilities on the site area will determine the areas suitability. For example, an integrated site or physical chemical/incinerator site which contains a 100 m smoke stack would be restricted in certain areas, however a landfill site, with a 20 to 30 m obstruction height, may not be restricted in the same area. Therefore, a proposed integrated site area may be used only as a landfill site area due to the airport constraints.

CHAPTER 6
MAPPING OF RAILWAY LINES

Unlike transmission lines (Chapter 4) and airports (Chapter 5), railway lines are considered both a constraint and an opportunity. A railway line cutting through a candidate area is a constraint to the siting and size of OWMC facilities. However, a railway line adjacent to an area provides an opportunity for rail transportation access. This chapter describes the mapping of active, abandoned and proposed to be abandoned railway lines with respect to the locations of candidate areas.

The maps included in this report illustrate the mapping of the four railway properties which cross the candidate areas: CN Rail, CP Rail, Toronto Hamilton and Buffalo Railway Company, and ConRail.

Due to the linear nature of this factor, it was not included in the composite constraint mapping used to select site areas; instead it was applied in site area screening.

1. SOURCES OF INFORMATION

Information on the location of active and abandoned railway lines was obtained from the OWMC 1:50 000 scale base maps and the railroad companies. The base plans provided data on existing active rail lines. In addition, the railway companies provided information on proposed abandonments of existing lines and abandoned lines where the right-of-way ownership was retained.

2. RAILWAY OPPORTUNITIES AND CONSTRAINTS

Proximity to railway lines is considered to be a positive factor. Where a railway line flanks the site property, an industrial access spur line could be constructed to provide interconnection with the national railway network. However, it would be undesirable to have a site straddle an existing rail line since the rail operation would form a physical barrier to site operations.

Railway lines which are abandoned or proposed for abandonment merit consideration as possible industrial spur lines. If the right-of-way for these lines was secured, the lines could then be reactivated for site-servicing.

3. RAILWAY MAPPING

The network of railway lines located in and around the candidate areas was mapped on overlays to the OWMC 1:50 000 base map series. The following maps, included in the Technical Data Map Portfolio, illustrate the mapping of existing active rail lines, existing rail lines proposed for abandonment, and abandoned rail lines (right-of-way retained by rail company). The abandoned lines retain the rail connections as shown, based on the information secured from the owners.

Map No.	Description
DT- 9	Railway lines in the Northern and 1A Regions
DT-10	Railway lines in the Western Region
DT-11	Railway lines in the Central Region
DT-12	Railway lines in the Eastern Region

Where some separation exists between a site and the rail line, the cost involved in securing right-of-way and constructing a spur line is a measurable constraint. This cost would be dependent upon the distance and topographic features between the site and the rail line.

The availability of abandoned lines as connections to active lines is another important consideration. The use of these lines would minimize the cost of spur line construction provided that continuity of the right-of-way exists back to the active line. The OWMC could protect for the future continuity of abandoned railway rights-of-way by informing the operating rail company of their interest in the line in question.

The linear nature of this factor did not make it suitable for the site selection consultant's composite constraint mapping process; however, this factor was applied during site area screening to select potential sites.

CHAPTER 7
MAPPING OF ARTERIAL ROADWAYS AND REGIONAL TRANSPORTATION COSTS AND ACCIDENT PROBABILITY

Previous studies (reference 4) have indicated that the truck mode is the one most likely to transport special wastes from source to receiver sites. Therefore, the proximity of an OWMC facility site to an arterial road and/or 400-series highway could reduce costs and risks of transportation by minimizing travel time and distance. These costs and risks are quantified in terms of cost and accident probability indices which indicate receiver centroids of relatively better or worst transport opportunities. This chapter documents the research and mapping of the proposed 1988 Ontario arterial road network and relates this to the locations of candidate areas.

The maps included in the Technical Data Map Portfolio accompanying this report illustrate the mapping of the three major types of arterial roadways and interchanges in the environs of the candidate areas: 400-series, other Provincial Highways and Regional Roads. However, the maps were not used in the composite constraint mapping since arterial roads provide a linear constraint. The maps were applied during site area screening to select potential sites.

The map showing combined regional transport cost and accident probability zones was used in constraint mapping to determine which zones had the best transportation opportunities.

1. SOURCES OF INFORMATION

Information for the mapping of the present and future (1988) arterial roadway network was obtained from the 1982-83 Provincial Road Map, and reports by and discussions with the Ontario Ministry of Transportation and Communications (MTC). The Provincial Road Map provided data on both the existing provincial and municipal arterial roadways. The Highway Program Development Branch of the MTC provided information on proposed provincial arterial road upgrading as identified in their report, Future Perspective Provincial Highways 1981 - 2001.

In the review of the MTC report, emphasis was placed on short-term projects which are proposed to be implemented on or before 1988 (the assumed opening date of the OWMC facilities). All provincial road projects for construction of new freeways or upgrading of arterial roads to expressways were identified and discussed with representatives of the MTC Capital Programs Section and/or the appropriate municipal road agencies. Only those projects which had advanced sufficiently towards the final design stage were assumed to be available by 1988 for inclusion in the provincial arterial roadway network.

2. ROAD IMPROVEMENT PROJECTS

The following sections provide a listing of the short-term (on or before 1988) and long-term (1989-2001+) road improvement projects for the Provincial arterial road network in the mapped areas. Only the short-term projects, listed in Section 2.1, were assumed to be in place for purposes of this analysis.

2.1 SHORT-TERM ROAD IMPROVEMENT PROJECTS

The following list of road improvement projects have either been completed or were assumed to become available by the year 1988.

1. Highway 403 is now in service from the Highway 401/410 junction in Mississauga to the Queen Elizabeth Way (QEW) in Oakville.

   The extension of Highway 403 from Highway 24 (Brantford area) to Highway 401 at interchange 236 (Woodstock area) is to be completed within five years.

2. Highway 404 will be extended as an expressway to the Davis Drive interchange in Newmarket from York Regional Road 40, within five years.

3. Highway 406 extension from Westchester interchange (St. Catharines) to the QEW is underway and will be completed by 1985.

   The Highway 406 southward extension, as an expressway, from Merritt Road (Thorold) to an interchange at East Main Street (Welland) is to be completed by about 1988.

4. Highway 410 is a staged freeway northwards from Highway 401. Two lanes now exist from Highway 401 to Steeles Avenue and will be upgraded to four lanes within the six to ten year period.

The section from Steeles to just north of Highway 7 will be constructed as an expressway and opened within five years.

The 410/403 interchange at Highway 401 provides movements to and from the east only at present. The full interchange will be opened within seven years.

5. Highway 27 extension from Rexdale Boulevard to just north of Highway 7 will be constructed to expressway standards within the next five years.

2.2 LONG-TERM ROAD IMPROVEMENT PROJECTS

The following improvements and extensions fall within the 1989-2001+ time frame. Those improvements were not considered in the analysis, but are tabulated to indicate opportunities which will evolve following the assumed opening date.

1. Highway 406 will be twinned to a four-lane divided expressway cross section from Beaverdams Road to Merritt Road interchange within ten years.

2. Highway 403 expressway between Oakville and Burlington to be undertaken within about ten years. The 403 section from Duff's Corners to Cainsville will be upgraded to an expressway in about ten years.

3. Highway 407 construction to expressway standards from Highway 410 to the Dufferin/Bathurst Street area should occur within 15 years.

Eastwards from there, to Highway 404 or the EMTC, construction is likely 20 years away. Westwards from Highway 410 to Highway 401 at Ninth Line, construction would be within 20 years.

4. Extension of the Oakville/403 link northwards to Highway 401 along Ninth Line and then into the Georgetown area should occur within ten years. This would be part of the Highway 407 expressway construction.

5. Highway 6 widening from Highway 401 to Hamilton (Highway 403) from two to four lanes will likely occur within the 20-year time frame.

6. Highway 3 realignment from Port Colborne to Jarvis will be controlled access and occur within 10 to 20 years.

7. The Highway 6 improvement project from Hamilton to Nanticoke is viewed to be a very long-term proposal. It is unlikely to occur within the 20-year time frame.

3. ARTERIAL ROADWAY MAPPING

The assumed 1988 arterial road network was plotted on overlays to the OWMC's 1:50 000 scale base map series. The following maps, included in the Technical Data Map Portfolio, illustrate the mapping of 400-series highways (including QEW), other provincial highways (including connecting links*), municipal arterial roads and major intersections.

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* Connecting Link: Any part of a provincial highway under the jurisdiction of City, Town or Village.

Map No.	Description
DT-13	1988 arterial road network for the Northern and Al Regions
DT-14	1988 arterial road network for the Western Region
DT-15	1988 arterial road network for the Central Region
DT-16	1988 arterial road network for the Eastern Region

4. FUNCTIONAL CLASSIFICATION OF HIGHWAYS

For transportation planning purposes, highways are most effectively classified by function. The functional classification system has eight major divisions as shown below in Table I-1.

TABLE I-1
HIGHWAY CLASSIFICATION - MAJOR DIVISIONS

RURAL*	URBAN*
Freeway	Freeway
Arterial	Arterial
Collector	Collector
Local	Local

Source: Geometric Design Standards For Ontario Highways, 1982, Ministry of Transportation and Communications.

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* The terms rural and urban refer to the predominent characteristics of the adjacent land use and not to jurisdictional boundaries.

The roadways shown on the arterial roadway constraint mapping are largely classified as Rural Freeways, Rural Arterial Roads, Urban Freeways and Urban Arterial Streets. Table I-2 and I-3 describe the characterization of each of these classifications of roadways and indicate how the mapped roadways fall into these classifications. It is apparent from Tables I-2 and I-3 that the characteristics of the 400-series highways, including the QEW, provide for the best traffic mobility.

5. CRITERIA FOR IDENTIFYING SITE AREAS

There are two considerations in identifying site areas with respect to roadway transportation: site access and proximity to 400-series highways. Good site access can minimize site access costs. Close proximity to 400-series highways minimizes the costs and risks of transporting goods to the treatment site.

Since the arterial roads system presents opportunities and some linear constraints, it was not included by the site selection consultant in the composite constraint mapping process. However, the by-product of the investigations; transport costs and accident probability, were used on a regional basis to indicate zones of good transport opportunities.

5.1 SITE ACCESS

The availability of Provincial highways and Regional roads to provide direct site access is an important transportation

TABLE I-2
CHARACTERISTICS OF RURAL ROAD CLASSIFICATIONS

	Rural Freeways	Rural Arterials	Rural Collectors	Rural Locals
Traffic Service	optimum mobility	traffic movement primary consideration	traffic movement and land access equal importance	traffic movement secondary consideration
Land Service	no access	land access secondary consideration	traffic movement and land access equal importance	land access primary consideration
Range of Traffic Volume A.A.D.T.	more than 8 000	1 000 - 12 000	200 - 5 000	not applicable
Characteristics of Traffic Flow	free flow	uninterrupted flow except at signals	interrupted flow	interrupted flow
Design Speed	100-120 km/h	80 - 110 km/h	60 - 100 km/h	50 - 80 km/h
Average Running Speed Off-Peak Conditions	80-115 km/h	60 - 100 km/h	60 - 90 km/h	50 - 80 km/h
Vehicle Type	all types heavy trucks average 20-30%	all types up to 20% trucks	all types up to 30% trucks mostly single unit type	predominantly passenger cars and light to medium trucks and occasional heavy trucks
Percentage of Total Length	up to 5	5 - 10	10 - 20	65 - 85
Connects to	freeways arterials collectors	all classifications	all classifications	arterials collectors locals
Example of Mapped Facilities	400-series highways and QEW	Provincial highways and municipal roads	Other municipal roads	None

Source: Geometric Design Standards for Ontario Highways, 1982, Ministry of Transportation and Communications.

TABLE I-3
CHARACTERISTICS OF URBAN ROAD CLASSIFICATIONS

	Urban Freeways	Urban Arterials	Urban Collectors	Urban Locals
Traffic Service	optimum mobility	traffic movement primary consideration	traffic movement and land access equal importance	traffic movement secondary consideration
Land Service	no access	land access secondary consideration	traffic movement and land access equal importance	land access primary consideration
Range of Traffic Volume A.A.D.T.	more than 20 000	5 000 - 30 000	1 000 - 12 000	not applicable
Characteristics of Traffic Flow	free flow	uninterrupted flow except at signals and crosswalks	interrupted flow	interrupted flow
Design Speed	90-120 km/h	80 - 110 km/h	50 - 90 km/h	40 - 60 km/h
Average Running Speed Off-Peak Conditions	70-110 km/h	50 - 90 km/h	30 - 70 km/h	20 - 40 km/h
Vehicle Type	all types up to 20% trucks	all types up to 20% trucks	all types	passenger and service vehicles
Percentage of Total Length	up to 10	up to 30	up to 30	70 approx.
Connects to	freeways arterials	freeways arterials collectors	arterials collectors locals	collectors locals
Example of Mapped Facilities	400-series highways and QEW	Provincial highways and municipal roads	None	None

Source: Geometric Design Standards for Ontario Highways, 1982, Ministry of Transportation and Communications.

factor. Areas which are not linked directly to the arterial road system would require either upgrading existing non-arterial roadways to arterial standards or construction of a new arterial road link to serve the area. The cost of upgrading existing roads or constructing new arterial links is a measurable constraint.

5.2 PROXIMITY TO 400-SERIES HIGHWAYS

Maximum use of 400-series highways and QEW is desirable from a transportation viewpoint. This is because information on roadway characteristics has indicated that freeways (the 400-series highways including the QEW) are the most efficient in terms of vehicular movements. In addition, Table I-4 indicates that freeways had the lowest accident rate for the five years between 1978 and 1982.

TABLE I-4
FIVE YEAR SUMMARY OF ACCIDENT DATA BY ARTERIAL CLASS, 1978-1982

	No. of Accidents	Million Vehicle Kilometres (MV km) of Travel	Accident Rate/MV km
Freeways	58 085	75 995.8	0.76
King's Highway	101 311	84 763.9	1.20
Secondary Highways	6 101	3 794.9	1.61
Other Roads	800 836	186 579.1	4.29

Source: Provincial Highways, Traffic Volumes: King's Highway and Secondary Highways, 1982, Ontario Ministry of Transportation and Communications.

5.3 REGIONAL TRANSPORT COST AND ACCIDENT PROBABILITY INDICES

As a by-product of the two previous criteria, the selection of site areas used information derived from the analysis of transport costs and accident probabilities indices, and applied them on a regional basis. The methodology for the calculation of these indices is fully described in Chapter 12 in Part II, and in Appendix D. In their application to constraint mapping, the two indices were combined to produce a composite index. By plotting the composite indices on a map of the study area (see Figure II-1), certain regional trends in relative transport access emerged which can be used to indicate areas of greater transport opportunities.

5.3.1 Determine most accessible areas

Table I-5 list the composite index for the receiver centroids examined. Each receiver centroid represents the candidate areas in its vicinity. The index value is an indication of the additional cost and/or accident probability of one centroid compared to another. The larger the index value the lesser the transportation opportunities.

The cluster centroids were grouped into four categories based upon the trends of the composite indices. The geographical display of these groupings is shown in Figure II-1 in Part II of this report.

5.3.2 Accessibility in combination with other factors

The analysis of regional transportation costs and accident possibility lead to an investigation into the possible trade offs between transportation accessibility and other factors such as hydrogeological and agricultural considerations. This investigation is described more fully in the Phase 3B: Selection of Candidate Sites - Site Selection report.

As part of this investigation six access routes into the "moderate, and "good" accessible areas were analysed with data on the accident probability and distance from 400 series highways. This information was used in combination with agricultural and hydrogeological constraints to determine what trade offs can be made among these three factors. Appendix J summarizes the accident and distance data for each of the routes examined.

TABLE I-5

RANKING OF RECEIVER CENTROIDS IN TERMS OF COMBINED COST AND ACCIDENT PROBABILITY INDICES

RANK	RECEIVER CENTROID	INDEX COMPOSITE	CANDIDATE AREA RANKING GROUP(1)
1	Mississauga	1.00	Best
2	Milton	1.09	Best
3	Bramalea	1.09	Best
4	Binbrook #2	1.24	Good
5	Caledonia	1.29	Good
6	Empire Corners	1.30	Good
7	Binbrook #1	1.30	Good
8	Carluke	1.33	Good
9	Bismarck	1.44	Moderate
10	Welland	1.47	Moderate
11	Caistor Centre	1.49	Moderate
12	Niagara Falls	1.51	Moderate
13	Winslow	1.51	Moderate
14	Boyle	1.53	Moderate
15	Elcho	1.64	Low
16	Wainfleet	1.72	Low
17	Chambers Corners	1.72	Low

Notes:

1. The regional groupings are mapped onto Figure II-1.

PART II
IDENTIFICATION OF POTENTIAL SITES
(SITE AREA SCREENING)

CHAPTER 8
INTRODUCTION

The OWMC's site selection process evolves from the development of site selection factors supplied by a number of disciplines. This involves the systematic evaluation of site areas based upon the application of these factors on a regional scale and later through a detailed, site-by-site investigation. The screening process which selects potential sites is carried out by applying a number of screens using different criteria at each level. During each screen, if there is any uncertainty about a site area's suitability, the site area is retained and reconsidered in the next step. The major steps in the process are as follows:

a) Site Size and Configuration: Using previously defined constraint-free site areas, site areas not meeting size and configuration criteria are eliminated.

b) Suitability Screen: Many constraining factors are applied to previously constraint-free site areas. Some of these factors may be significant enough to eliminate an entire area and others may only constrain the site area's size, which may or may not result in the site area's elimination.

c) Compatibility Screen: The site areas which pass the suitability screen are considered with respect to the type of facilities (i.e. incinerator-physical/chemical treatment plant [PI]) that are suitable for the land uses in these areas.

d) System Screen: The various possible sites and site facilities are considered with the preferred arrangements being PI sites close to landfills, and configurations which make use of access roads through a minimum number of sensitive areas.

Transportation factors were applied during the Suitability and to a lesser degree the System Screen. There were four factors considered in the Suitability Screen: transmission lines, airports, railways, and roadways. These four factors were mapped as boundary delineation constraints, although railways and roadways are factors which can also provide site-servicing opportunities. The System Screen used travel distance between PI and LF sites, transportation cost, and accident probability as site area screening factors. These latter two factors, although developed during constraint mapping and site area screening, were used on a comparative basis, and served to give an indication of the relative cost or risk within the different areas surrounding the receiver centroids.

The Site Area Screening follows from the factor development discussed in Part I of this report, which dealt with the constraint mapping of the transportation factors onto 1:50 000 scale base maps of otherwise constraint-free areas. The site area screening examines the 152 sites, which were identified through constraint mapping, on a more detailed level using a two step screening process. The first step used 1:50 000 base mapping to eliminate some areas, and the second step involved field visits of the 90 remaining sites and the screening of site areas at the 1:10 000 base map scale.

This portion of the report concentrates on the application of the transportation related factors to the site area screening and their relative ranking in terms of their transportation attributes.

Appendix B shows a worked example of the application of site area screening factors through the field and office review of site LF-4W including a 1:10 000 scale plan of the site area. Appendix C includes all the site area screening factor sheets describing their significance and use in this step of the site selection process.

CHAPTER 9
OVERVIEW

Following the analysis of the composite constraint mapping (which mapped factors from all disciplines), 152 site areas emerged as being suitable for supporting special waste treatment facilities. The objective of the site area screening process is to narrow these various site areas to a number of potential sites by applying factors on a more site-specific basis.

The transportation factors applied during this portion of the site selection process include: railways, arterial roadways, utility transmission lines, airports, distance between landfill and PI sites, transportation costs, and probability of transport accident. All of these factors were developed from the Phase 3 goals and objectives during constraint mapping, but during site area screening these factors are applied in greater detail. The latter two factors are applied only on a comparative basis.

The screening process followed a two step procedure. Step one was a screening of the 152 site areas based on the factors applied to 1:50 000 scale base mapping. The 90 site areas which survived this application of factors from all disciplines, were then subjected to a more detailed screening which used 1:10 000 scale base plans. This detailed screening was composed of two steps: the field investigation, and the office review. The field investigations involved visiting the 90 site areas and recording information on the existing transportation constraints or opportunities onto 1:10 000 scale plans and field data sheets. The office review was designed to cross-check the findings from the field by using 1:10 000 and 1:50 000 scale plans and agency contacts. The result of these two steps is a comprehensive inventory of the transportation constraints and opportunities and a recommendation of each site area's transportation suitability (see Appendix B for worked example of procedure using site LF-4W). A similar procedure was carried out by all disciplines producing extensive documentation on each site area which could be used to identify suitable potential sites.

The two other factors applied in site area screening at the 1:10 000 scale step; transport costs, and accident frequency, were developed with the aid of the MOTORS* computer programs, details on the Ontario highway network, the estimated waste sources and quantities, and the five-year average Ontario motor vehicle accident rates. The computer program, compiled this information to provide input for the calculation of transportation costs and accident frequency indices for 17 cluster centroids representing groups of adjacent site areas. The program ouputs, at this stage, were not detailed enough to screen specific site areas, but they were used as an indicator of transportation costs and accident risks in subareas within the study region. The program outputs were later enhanced to be useful in the initial comparative evaluation step.

Appendix E document the findings of the transportation site area screening step for all of the 152 site areas.

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* See Appendix D for details.

CHAPTER 10
FIELD INVESTIGATIONS

The field investigations were carried out on 90 of the 152 site areas identified following constraint mapping. The number of site areas was reduced through a preliminary examination of the site areas using 1:50 000 scale plans.

The objective of the field investigation was to collect precise data on the various transportation factors affecting 90 site areas. The field investigation team consisted of two to three people who toured through the site areas recording the location of transmission and utility lines, airport, railway, and roadway information on film and field recording sheets (see Appendix B). Results of the field investigations were examined further in the office reviews.

1. TRANSMISSION LINES

The transmission lines portion of the investigation was concerned with the status of electrical, gas and oil, sewage and water, and telephone transmission facilities in or adjacent to site areas. Transmission line field data sheets, shown in Appendix B, were used to record the information. There was a separate data sheet for each type of transmission line facility investigated.

The electrical transmission line investigation concentrated on obtaining a precise line location, corridor size, transmission voltage, and facility expansion possibility. This information was later used as an input to deciding a site area's suitability.

Similarly, investigations of gas and oil pipelines, sewer and water trunk lines, and trunk telephone lines collected information on the location, size and types of facilities present.

Information was also collected on existing local utility services along roadways adjoining or passing through site areas. This information was applied for those site areas requiring road closures and thus utility relocation.

2. AIRPORTS

The investigation of airport facilities was carried out to collect information on the status of airports in the vicinity of potential sites. The Airport Field Data sheets (see Appendix B) were used to record the data.

The investigating team collected data on airport location, distance to site from runway, direction of runways and level of airport activity.

This information was later used to estimate the extent of an airport's obstacle protection control areas (see Chapter 5), and its influence on site areas.

3. RAILWAY LINES

The status of all railway lines, active or abandoned, around a site area was noted during the field investigation. Railway Field Data sheets (see Appendix B) were used to record the data.

Information on rail line ownership, location, characteristics, and presence of spur lines was assembled and recorded. This information was later used to estimate the site's accessibility from a railway viewpoint, by considering the length of the spur line required to connect the site to major railway lines, and any site or configuration constraints imposed by the rail line.

4. ARTERIAL ROADWAYS

Arterial roadways include existing Regional Roads (those roadways under the jurisdiction of the regional government) and existing local roads (under the jurisdiction of local government) which may need to be upgraded to arterial roadways in accordance to the load limits imposed considering the increase in traffic expected for accessing the OWMC facilities.

The investigation reviewed the status of arterial roadways in the vicinity of the site areas. The results were recorded on the Roadway Field Data sheets shown in Appendix B.

The investigation team recorded information on type, location, surface, and classification designation of roadways within a site's vicinity, as well as the name of the municipality responsible for the road's operation. This information was later used to estimate a site area's suitability by considering the length of roadway reconstruction, the consequences of closing of existing local roads and the need for construction of new roads and detours.

CHAPTER 11
OFFICE REVIEW

The objectives of the office review were to document the field investigation information, cross reference the data using secondary sources of information, and draw conclusions regarding the site area's suitability in terms of each transportation factor. The field investigation was documented by plotting field information on 1:10 000 scale plans of each potential site. Secondary sources of information included OWMC 1:10 000 and 1:50 000 scale maps, and Transport Canada and pipeline companies contacts. These were used to verify field information, and to obtain input on transportation factors. Following the evaluation of information, conclusions were drawn regarding the potential site's suitability. Examples of the forms used in the office review are included in Appendix B.

Following the office review a complete filing system, which sorted the information according to site area code numbers, was set up in the M.M. Dillon Limited and OWMC offices. This filing system includes information from all consultants involved in site area screening.

1. TRANSMISSION LINES

The office review of the transmission line field data included information on hydro power lines, oil and gas pipelines, sewer and water trunk systems, and Bell telephone trunk lines. The transmission line field information was plotted on 1:10 000 scale plans of the site areas. The information was cross-checked with base

base mapping and other secondary sources to confirm corridor size and location, transmission size (i.e. voltage, number of cables, number of towers, etc.), owner, and proposed improvements. Based these site area were recorded on transmission line office data sheets. Examples of these sheets are included in Appendix B.

Due to the sensitive nature of the project, it was not possible to contact all of the authorities governing the transmission lines; however, a number of pipeline owners were contacted regarding details on their pipeline locations.

Utility lines within public roadway allowances, which were identified during the field review, were mapped on the 1:10 000 OWMC base maps for each site area. This included utilities along roadways on the perimeter of the site area as well as those within roadway allowance that would require relocation if road closures were required.

2. AIRPORTS

The airport field data was reviewed with particular attention to the site area's interference with an airport's flight path and any obstacle controls which apply in the airport's environment (see Chapter 5). An initial review of these conflicts was done using 1:50 000 and 1:10 000 scale base maps and Airport Field Data sheets. Appendix B contains an example of an Airport Office Information sheet which was used to record information gathered and draw conclusions at the office review stage.

A more detailed review of the affects of airports on the site identification process required input from Transport Canada since they have an interest in the the environment around any airport. Transport Canada was requested to comment on what affects some of the site areas may have on specific airports in southern Ontario. Transport Canada's recommendations were taken into consideration when commenting on a site area's suitability. Table II-1 shows the airports investigated and Transport Canada's comments.

TABLE II-1
TRANSPORT CANADA'S COMMENTS ON SITES
NEAR SOUTHERN ONTARIO AIRPORTS

Area	Airport Affected	Transport Canada's Comments*
Milton	Burlington Airpark	- no obstruction to use
Wainfleet	Welland/Port Colborne	- likelihood of navigational restraint
Brampton/ Mississauga	Lester B. Pearson International (Transport Canada controlled)	- various adverse conditions and restrictions were noted in relation to specific sites
Hamilton-Wentworth	Hamilton Civic (Transport Canada controlled)	- various adverse conditions and restrictions were noted in relation to specific sites

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* Information collected from meetings and correspondence between Transport Canada Officials and M.M. Dillon Limited.

3. RAILWAYS

While investigating the information on railway lines, the analysis concentrated on the site area's proximity to active and abandoned rail lines as both an access opportunity and a locational constraint. The field data were cross-checked with 1:50 000 and 1:10 000 scale maps in order to confirm information on the railway's location, trackage and elevation, and the site area's elevation and possible conflicts with railyards or junctions. This information was used to establish the possibilities of railway access and railway constraints at each site area. The information and conclusions were recorded on the Rail Office Information sheets, an example of which is shown in Appendix B.

4. ARTERIAL ROADWAYS

Roadway field information was reviewed to estimate a site area's arterial access capabilities. In addition, it was necessary to examine the possible affects of detours and local road closures (made necessary where a roadway traverses a site) will have on the surrounding environment. This analysis was done by cross-checking field data with 1:50 000 and 1:10 000 scale base plans, and observing the alternative routes available in the site's vicinity. The results of the office review were recorded on the Roadway Office Information sheet, an example of which is shown in Appendix B.

Site areas which straddled regional roads and provincial highways were constrained in terms of size and configuration since the closing of these arterial roadways was viewed to be an exclusionary constraint. However, if the remaining portion of the site area, on either side of the roadway, was large enough to support OWMC facilities, the site area boundaries could be refined to enhance its suitability.

Agencies responsible for the operation and maintenance of the roadways could not be contacted, during Phase 3, due to the sensitivity of this investigation.

CHAPTER 12
TRANSPORTATION MODEL INPUTS

1. INTRODUCTION

The transportation model originally developed during constraint mapping was applied during the site area screening step to produce information which could be used to calculate surrogates for transportation costs and accident probabilities for receiver centroids representing groups of site areas. Although the program's capability was more fully used in the initial comparative evaluation of potential sites, its development, testing, data collecting and application at a coarse level of detail, provided an initial index of cost and accident probability suitable for the site area screening step.

The purpose of this chapter is to outline the methodology, sources of information, and assumptions made in determining the transportation model's inputs. The model development is fully described in Appendix D.

There are four major inputs to the transportation model:

- the location of waste source sites;
- the quantity of wastes produced at each source site;
- the location of receiver centroids (representing groupings of site areas);
- the Ontario highway network (stratified into freeways, King's highways, secondary highways, and other arterial roads).

These inputs were developed and applied to the model to produce the following outputs for each receiver centroid:

- the minimum distance from each source site;
- the minimum time from each source site;
- the quantity of waste hauled over each link for each route (stratified by freeways, King's highways, secondary highways and other roads);
- the five-year average vehicle accident rate for each link class (stratified by freeway, King's highways, secondary highways, and other arterial roads).

The analysis of these outputs and their applicability to the screening process is described in Chapter 13.

2. LOCATION OF WASTE SOURCES

The sources of Ontario's hazardous wastes have been investigated in previous studies (Proctor & Redfern Report, reference 5) and it was assumed these findings will still be valid at the time the facility is constructed.

The source point (origins) of each of the municipal areas was selected on the following basis:

- centrally located and easily accessible from all points within the municipal area;
- high population and/or industrial density within area.

The theoretical municipal source point within each municipal area is shown in Table D.1 (page D-8) in Appendix D.

3. SPECIAL WASTES QUANTITIES

One of the initial investigations carried out by the OWMC was the identification of special wastes generated by municipalities within the Province of Ontario. This was reported in the Waste Quantities Study report (reference 5).

Using this background document, the OWMC undertook the development of various annual special waste volume scenarios. The scenario developed for use in the transportation analysis was one involving a nominal 150 000 tonnes per annum. It appeared reasonable to assume that this level of use would likely develop within the initial five years after construction of the OWMC treatment facilities.

The waste stream source locations and quantities as developed by the OWMC are as set out in Table II-2. These were the special waste quantities that were input to the transportation cost analysis.

It was not practical at this stage to link all 48 waste producing sites or areas, for purposes of transporting wastes, from source to receiver sites. The last five areas identified in Table II-2 are large geographical areas covering many hundred of square miles and producing only 2 449 tonnes of waste per annum. When this is compared with the total of 151 320 tonnes per annum, their quantity amounts to 1.6% of the total waste stream.

TABLE II-2

SPECIAL WASTE GENERATION BY MUNICIPAL AREA

LOW VOLUME SCENARIO

Municipal Area	Volume (tonnes)
Hamilton	27 179
Toronto	30 996
Sault Ste. Marie	7 962
Mississauga	8 423
Kitchener	7 964
Windsor	6 825
Welland	6 529
Brampton	5 324
Sarnia	5 069
St. Catharines/Niagara Falls	3 979
Oshawa	4 200
Aurora	3 558
Thunder Bay	1 934
London	3 180
Barrie	1 983
Oakville	2 315
Cornwall	1 346
Guelph	1 757
Ottawa	1 721
Simcoe	1 470
Kingston	1 492
Cochrane	817
Woodstock	1 483
Chatham	1 379
Kirkland Lake	977
Brantford	1 114
Brockville	881
Belleville	780
St. Thomas	737
Cobourg	846
Halton Hills	548
Stratford	521
North Bay	450
Peterborough	487
Sudbury	305

TABLE II-2

SPECIAL WASTE GENERATION BY MUNICIPAL AREA

LOW VOLUME SCENARIO

(continued)

Municipal Area	Volume (tonnes)
Grimsby	410
Hawkesbury	257
Huntsville	150
Lindsay	139
Owen Sound	241
Dunnville	141
Orangeville	174
Walkerton	86
Other - Northwest	776
Other - Southeast	922
Other - South Central	358
Other - Southwest	240
Other - Northeast and Central	153
TOTAL	151 320

NOTES:

1. Numbers have been rounded.
2. Municipal Areas include all of the communities outlined in Appendix G of the Waste Quantities Study. Proctor & Redfern Limited. August 1982 with annotations by M.M. Dillon Limited to improve clarity (reference 5).
3. Low volume scenario developed by OWMC staff from Waste Quantities Study.
4. Distribution of quantities as per report by Pilorusso *et al.* (referance 4).

Therefore these five source sites were excluded from the model network leaving 43 municipal source areas, and 148 871 tonnes of special wastes per annum.

All the remaining 43 municipal areas identified in Table II-2 and the waste quantities for each area were input to the transportation model.

4. LOCATING RECEIVER CLUSTER CENTROIDS

The locating of receiver cluster centroids was an iterative process involving network testing and refinement. The selection process was carried out in parallel to the development of the highway network discussed in Appendix D (Chapter D.3, page D-5). The objective in selecting centroid locations was to determine the preferred truck routes into regions where site areas had been identified.

The first stage in the analysis was based upon four cluster centroids located within the candidate areas represented by the Mississauga and Milton areas and two locations within the western portion of the Niagara Peninsula area. Following a review of the road network routings, based upon these receivers, and appropriate modifications to the network routings external to the candidate areas, an additional 13 cluster centroids were introduced. Further network evaluation was then carried out, mainly within the candidate areas, and further appropriate network routing adjustments were then made.

The locations of the final 17 cluster centroids are tabulated below. The locations are also displayed in Figure II-1. More information is available in Appendix D (Chapters D.4, D.5, D.6; pages D-16 to D-33) as to the methods and procedures used in network refinement and selection.

Centroid No.	Cluster Centroid Name	Site Location Description
44	Caledonia	Intersection of Highways 6 and 54
45	Binbrook #1	Binbrook Road East at Halton-Wentworth/Niagara Boundary
46	Bismarck	On Highway 20 Bismarck
47	Welland	Intersection of Highway 58 and 58A
48	Niagara Falls	Intersection Niagara Regional Roads 98 and 47
49	Milton	On Highway 25 near Omagh
50	Mississauga	Junction of Highways 401 and 10
51	Carluke	Intersection of Sawmill Road and Carluke Road
52	Binbrook #2	Intersection of Hamilton-Wentworth Regional Road 622 and Highway 56
53	Empire Corners	Hamilton-Wentworth Regional Road 19, 3 km west of Empire Corners
54	Caistor Centre	Niagara Regional Road 65, 2 km west of Niagara Regional Road 14
55	Winslow	Niagara Regional Road 65, 0.5 km west of Niagara Regional Road 16
56	Elcho	1.5 km east of Niagara Regional Road 16 on Elcho Road
57	Boyle	Intersection of Highway 20 and Niagara Regional Road 24
58	Chambers Corners	3 km west of Niagara Regional Road 24 on Wilford Road
59	Wainfleet	1.5 km west of Highway 3 on Abbey Road South
60	Bramalea	Intersection of Highway 7 and Airport Road

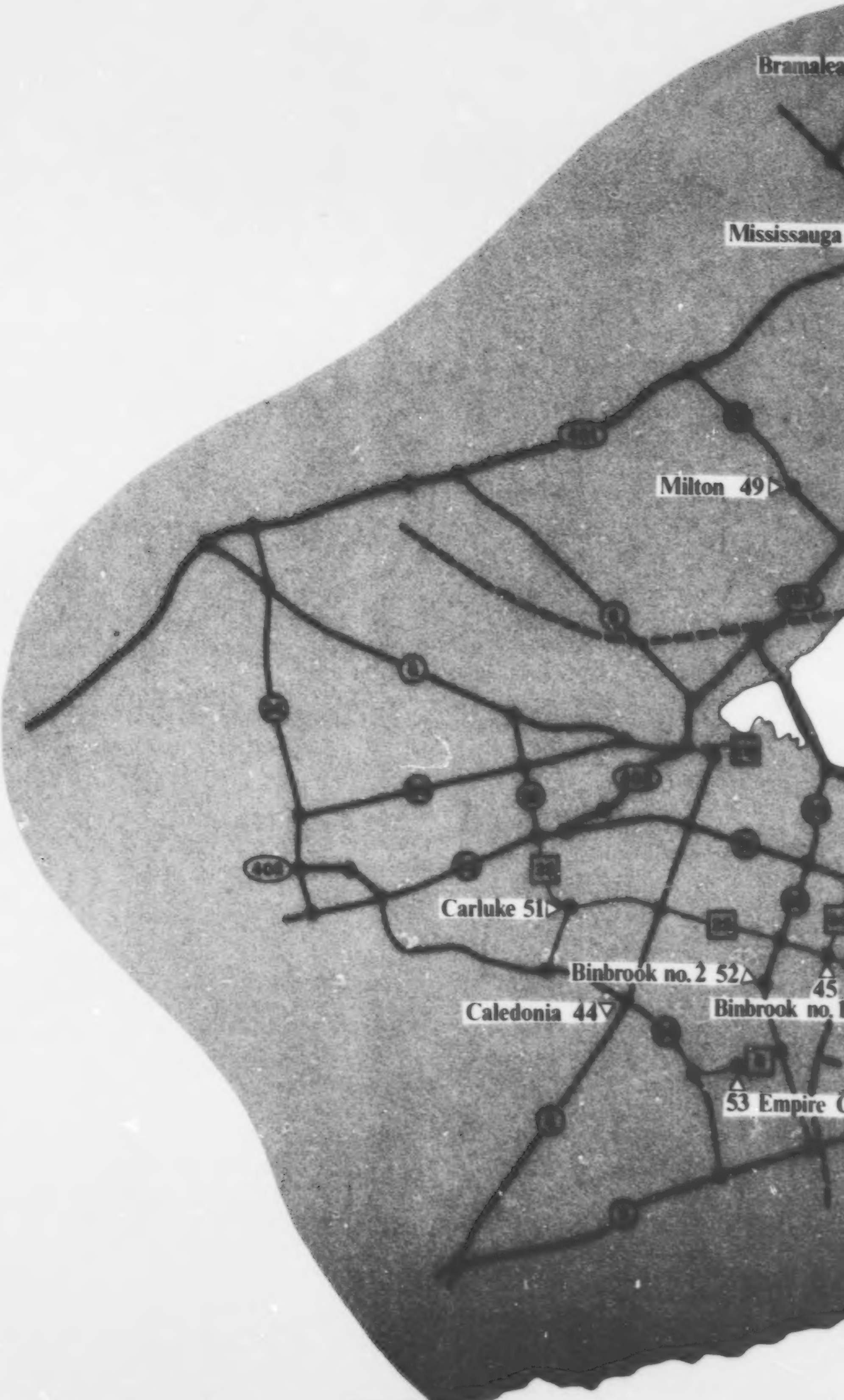
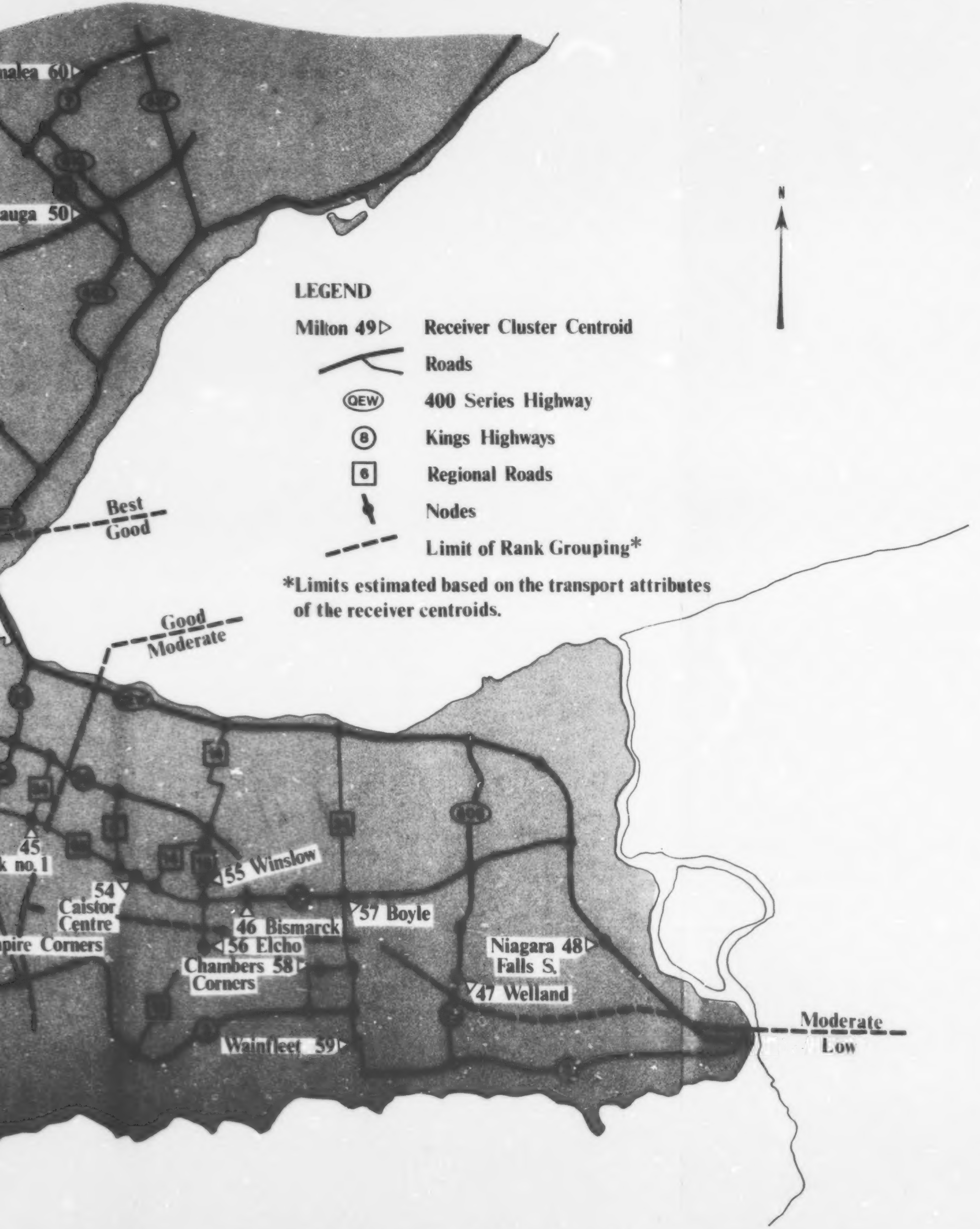

Bramalea
Mississauga
401
Milton 49
Carluke 51
Binbrook no. 2 52
Caledonia 44
45
Binbrook no. 1
53 Empire C

Fig. II-1 Road Network Links an


nalea 60
auga 50
LEGEND
Milton 49▷ Receiver Cluster Centroid
Roads
QEW 400 Series Highway
8 Kings Highways
6 Regional Roads
Nodes
Limit of Rank Grouping*
*Limits estimated based on the transport attributes of the receiver centroids.
N
Best
Good
Good
Moderate
45
k no. 1
54
Caistor
Centre
pire Corners
55 Winslow
46 Bismarck
56 Elcho
57 Boyle
Chambers 58
Corners
Niagara 48
Falls S.
47 Welland
Wainfleet 59
406
Moderate
Low

s and Receiver Centroids Within the Candidate Area and Environs

5. THE OWMC HIGHWAY NETWORK DEVELOPMENT

The objective in building a highway network for the OWMC site selection process was to produce an analytical tool to be used for the determination and selection of preferred trucking routes from points throughout the Province of Ontario to receiver centroids representing groups of site areas.

The highway network is represented by a series of interconnecting links joined by nodes. Each link has common characteristics (i.e. speed, classification, etc.). This network of links facilitates and determines the best path of movement between pairs of origin and destination points.

The information required prior to building a transportation network is:

- study area boundary;
- level of detail required in the highway network;
- breakdown of study area into zones (i.e. source and receiver zones);
- identification of appropriate source and receiver centroids for each zone in the network;
- highway link information (i.e. length and operating speed);

These network informational requirements are discussed in this chapter and Appendix D (Chapter D.3, page D-5).

THE STUDY AREA

The study area has been previously specified to include all producers of liquid industrial waste and special waste in the Province of Ontario.

Therefore, the study area boundary has been assumed to be the provincial boundary. Waste producers outside the Province have not been considered.

WASTE GENERATING ZONES

The Province has been divided into 43 waste-generating municipal areas or zones as discussed in Section 2. This breakdown was identified in the OWMC Waste Quantities Study (The Proctor & Redfern Group 1982, Appendix G) where the constituent municipalities were determined for each area.

RECEIVER CENTROIDS

The identification of receiver centroids paralleled the highway network development and is outlined in Appendix D (Chapter D.8, page D-37). The original four test centroids were expanded to 17 as the highway network was refined to reflect possible access routes to site areas.

THE HIGHWAY LINK DATA

The purpose was to examine possible truck routings between network loading and unloading points representing the 43 waste-generating municipalities in Ontario and those receiver zones represented by the 17 receiver centroids.

Highway link data was established to simulate an up-to-date Provincial highway system that would connect these zones. Highway improvements and extensions projected to occur up to the year 1988 were included in the network.

The level of network detail required for the original network testing includes all King's highways, regional arterial roads, and some key secondary highways. As the analysis progressed, the network was refined to provide a much higher level of detail in and around the receiver centroids based on the selection of preferred routes as discussed in Appendix D (Chapter D.7, page D-34).

For each link in the network it was necessary to specify the length of the link and the operating speed on the link, which relates to the design standards of the roadway and the posted operating speed. The link length and operating speed data was extracted from the MTC data bank maintained by their Demand Analysis Office. The derivation of this information is discussed in Appendix D.

6. ACCIDENT RATES

Accident probability is based on the historical vehicle accident rates along the routes between the waste sources and the receiver centroids. The standard measurement for these rates is the annual number of accidents per one million vehicle-kilometres. This measurement takes into account that the accident rate on a road section is dependent on the number of accidents per annum, the number of vehicles using the road section per annum and the length of the road section.

The Ontario Ministry of Transportation and Communications maintains records on all-vehicle accident rates for all major roadways in the province, separating the rates by road class. Although special waste will be transported by truck, the all-vehicle accident rate is used in the Phase 3 analysis. The all-vehicle accident rate is considered representative of one route's safety as compared to another's. Consequently, these rates are viewed to be adequate as indicators for the comparative evaluation and screening of sites.

The accident rate for a particular length of road with a particular volume of traffic is dependent on the roadway's geometrics standards (i.e. classification of roadway) and the surrounding environment. Since most of the travel will be along roadway links in Southern Ontario, it was assumed, for the Phase 3 analysis, that the surrounding environment for all roadways was relatively the same. However, accident rates were stratified into the four Ontario roadway classifications: Freeways, King's Highways, Secondary Highways, and Other Roads. The five-year (1978-1982) accident rate for each of these roadway classifications is shown in Table II-3. The five-year average accident rate is also shown.

TABLE II-3

FIVE-YEAR SUMMARY OF ONTARIO ACCIDENT DATA

YEAR	FREEWAYS		KING'S HIGHWAY		SECONDARY HIGHWAYS		HIGHWAYS OVERALL		OTHER ROADS	
	Accidents	MV KM	Accidents	MV KM	Accidents	MV KM	Accidents	MV KM	Accidents	MV KM
1978	11 304	14 678.2	20 161	17 075.3	1 080	700.6	32 545	32 454.1	153 818	36 862.9
1979	11 524	15 172.8	21 648	17 169.4	1 252	733.8	34 424	33 076.0	162 772	39 085.4
1980	10 913	15 609.7	20 760	16 962.5	1 287	765.8	32 960	33 338.0	163 541	39 153.5
1981	12 410	15 199.6	20 525	16,906.8	1 266	787.0	34 229	32 908.4	164 143	37 997.6
1982	11 934	15 335.5	18 217	16 649.9	1 216	807.7	31 381	32 804.3	156 562	33 479.7
AVG.	11 617	15 199.16	20 262	16 952.78	1 220	758.98	33 107	32 916.16	160 167	37 315.82
RATE (accidents/ mill.veh-km)	0.76		1.20		1.61		1.00		4.29	

SOURCE: Provincial Highways, Traffic Volumes: King's Highways and Secondary Highways, 1982, Ontario Ministry of Transportation and Communications.

CHAPTER 13
ANALYSIS OF MODEL RESULTS

1. INTRODUCTION

The output from the transportation model was used during the screening of site areas step to determine any differences in transportation costs or transportation accidents that would indicate whether certain receiver centroids are locationally better than others. To achieve this objective it was necessary to first analyze the routes selected by the model, second to develop indicators for transport costs and accident frequencies, and finally to determine which site areas possess the best transport opportunities and least constraints.

This chapter discusses each of these analyses procedures and concludes that a receiver site in the Mississauga or Milton areas incurs the least transportation cost and has the minimum accident frequency; sites in the Niagara Peninsula have the poorest transportation rating. It is recommended that the model's sensitivity to the distribution of waste sources, quantities, and the access road opportunities be investigated further in Phase 4.

The results of the accident analysis as used in the composite analysis is described in the Phase 3B: Selection of Candidates Sites - Site Selection Report. This factor was chosen for this purpose because it represents the transportation risk associated with the access roads near the site areas.

2. ROUTE SELECTION

Although the transportation model identified the shortest time and distance routes between source sites and receiver centroids, these routes were not necessarily the most desirable routes. The routes identified by the model were carefully examined to determine their relative acceptability. This examination placed emphasis on:

- the maximized use of 400 series freeways and
- the avoidance of populated areas.

In many cases it was found that the fastest or shortest routes were also the most acceptable, however, there were a few instances where a somewhat longer or slower route was more acceptable. In such instances the highway network was modified so that the traffic would be routed along the more desirable route. Appendix D (Chapters D.4, D.5, D.6, D.7; pages D-16 to D-26) discusses this route refinement process in more detail.

Once satisfied that the network routing reflected the more acceptable routes, the quantities of wastes from each source and the accident rate for the various classes of roadways was applied to the network model.

3. TRANSPORTATION COST INDEX

A transportation cost index was used to compare the transportation merits of the different cluster centroid locations. The cost was calculated as tonne-kilometres, a combination of the quantity of special waste and distance that the waste is hauled. The cost index was developed to compare the cost of one receiver centroid relative to the centroid with the lowest cost. For example the transportation cost for a centroid with the index value of 1.47 can be expected to be 1.47 times (or 47% higher than) the cost of the centroid with an index value of 1.00.

At this point in the site selection process, information on the cost of special waste haulage has not been finalized; however, the indexing of the tonne-kilometres of special wastes hauled gives a good indication of the relative costs of locating treatment facilities in different regions of the candidate areas, as described in Constraint Mapping.

To undertake detailed transportation cost estimates more specific information is required, including:

- the type of vehicles used in haulage;
- refinement of current estimates of quantities of wastes to be treated,
- quantities and source of additives and reagents to be used in the treatment process.

The first two points are to be dealt with in Phase 4A of the Facility Development Process, while the final point is addressed further during the initial comparative evaluation step.

The information used in deriving the tonne-kilometre value was the estimated quantities of special wastes produced at source sites and the routes selected for special waste transport. The assumptions made and sources of information used with respect to the waste quantities are outlined in Chapter 12. The selection of routes is explained in Section 2 of this chapter.

Table II-4 presents the findings of the cost analyses which indicate that site areas near Mississauga have the lowest transportation cost index and those near Niagara Falls have the highest. The former area's low transport cost index can be attributed to its proximity to Toronto and Hamilton, the largest source of special wastes, and to the fact that wastes from distance sources, such as, Thunder Bay and Ottawa, must pass near Mississauga before reaching the latter receiver areas.

4. ACCIDENT PROBABILITY INDEX

The accident probability index was developed to represent the relative transportation safety of each of the 17 receiver centroids. The proxy for accident probability is the sum of the products of the five-year average accident rate for each road class and the annual tonne-kilometres of special waste haulage on each road class. The probability is expressed in an index form calculated in the same manner as for the transportation cost index.

The information used in deriving the accident probability was the five-year average accident rates for the four roadway classifications and the annual tonnes-kilometres of waste hauled along each of the roadway classes. The source of information for accident rates and roadway classifications is presented in Chapter 12. The derivation of the tonne-kilometre values is discussed in Section 3 of this chapter.

TABLE II-4

RANKING OF RECEIVER CENTROIDS IN TERMS OF TRANSPORTATION COST INDICES

RANK	RECEIVER CENTROID LOCATION[1]	INDEX
1	Mississauga	1.00
2	Milton	1.08
3	Bramalea	1.09
4	Binbrook #2	1.16
5	Carluke	1.20
6	Binbrook #1	1.22
6	Empire Corners	1.22
8	Caledonia	1.26
9	Caistor Centre	1.28
10	Winslow	1.32
11	Elcho	1.34
11	Bismarck	1.34
13	Boyle	1.39
14	Chambers Corners	1.46
15	Wainfleet	1.47
16	Welland	1.49
17	Niagara Falls	1.55

NOTES:

1. The site areas associated with these receiver centroid locations are tabulated in Appendix E.

Table II-5 shows the results of the comparison and the relative ranking categories used in the composite analysis by the site selection team to illustrate regions of relatively safer transport access.

The results indicate that some receiver centroids which ranked lower in the transport cost index comparison, have a higher accident probability index ranking. This change occurs because the routes to these receiver centroids are safer, although somewhat longer than the route to the others. This is particularly true for the Niagara Falls centroid which has the largest cost index values, but due to its proximity to the QEW, which has a low accident rate, it has a smaller accident probability index than almost one-half of the other receiver centroids. The Mississauga area has the lowest index due to the combination of its proximity to sources and good access routes with low accident rates.

5. CONCLUSIONS

The centroids with the minimum transportation cost and accident probability indices are located in the Mississauga, Milton and Bramalea areas and the poorer ranked sites are in the Niagara Peninsula. The former areas have both better freeway access and a better location with respect to waste sources, than any of the other areas. These findings were used to compare site areas in terms of their regional transportation costs and risks, the comparative evaluation step will more precisely evaluate the costs and accident probabilities of the potential sites near all the centroids and use the findings to select candidate sites.

TABLE II-5
RANKING OF RECEIVER CENTROIDS IN TERMS OF ACCIDENT PROBABILITY INDEX

RANK	RECEIVER CENTROID LOCATION[1]	INDEX	RELATIVE RANKING GROUPS[2]
1	Mississauga	1.00	Best
2	Bramalea	1.09	Best
2	Milton	1.09	Best
4	Binbrook #2	1.31	Good
4	Caledonia	1.31	Good
6	Empire Corners	1.38	Good
7	Binbrook #1	1.39	Good
8	Carluke	1.45	Good
8	Welland	1.45	Good
10	Niagara Falls	1.46	Good
11	Bismarck	1.53	Moderate
12	Boyle	1.66	Moderate
13	Caistor Centre	1.69	Moderate
14	Winslow	1.70	Moderate
15	Elcho	1.93	Low
16	Wainfleet	1.96	Low
17	Chambers Corners	1.98	Low

NOTES:

1. The site areas associated with these receiver centroid locations are tabulated in Appendix E.

2. These ranking groups were applied to the composite analysis by the site selection team.

CHAPTER 14
APPLICATION OF SITE AREA SCREENING

1. INTRODUCTION

The objective of the site area screening step was to reduce the 65 landfill/integrated (LF) and 87 physical chemical/incinerator (PI) sites identified as constraint-free areas in constraint mapping, to a number of potential sites for comparative evaluation. In carrying out this step, site area screening factors developed by a number of disciplines were applied to each of the constraint-free areas. This chapter describes the application of the transportation factors in this step, and the ranking of these site areas in terms of these factors.

2. FACTORS USED IN SCREENING

The transportation factors used to identify potential sites were applied at the Suitability and System Screening levels as listed in Table II-6. The factor "travel distance between PI and Landfill site areas" was used as an input to the development of the transport cost and accident probability factors. The cost and accident factors were not used independently to identify potential sites because this data referred only to the general areas surrounding a receiver centroid, however the distance between PI and Landfill sites was used to determine which Landfills and PI sites would provide the optimum partially integrated site combination.

TABLE II-6
TRANSPORTATION FACTORS USED IN SITE AREA SCREENING

SUITABILITY SCREEN FACTORS

- Transmission lines (hydro, pipe, Bell, etc.) through or in proximity to site areas
- Provincial highways and regional arterial roads through or in proximity to site areas
- Rail lines through or in proximity to site areas
- Airport facility conflicts with site areas

COMPATABILITY SCREEN FACTORS

- No transportation factors involved

SYSTEM SCREEN FACTORS

- Travel distance from PI to landfill site areas (an input to transportation costs and accident probability)

NOTE:

1. The application of factors with this process is included in Appendix E, Tables E-1 and E-2.

In Site Area Screening each screen is used systematically to eliminate possible site areas. The Suitability Screen is the first screen, site areas which survive this screen enter the Compatability Screen. The System Screen applies only to site areas surviving the Compatibility Screen. The result of this screening is a ranking of the site areas in terms of their transportation attributes.

Appendix E presents information on how each of the site areas are constrained by each of the transportation site area screening factors. Table E-1 in the Appendix shows the site areas associated with each receiver centroid, and the transportation cost and accident indices for each. Table E-2 lists, for all the site areas, their scale of screening and the remaining transportation Suitability and System Screening factors applied.

3. TRANSPORTATION RANKING OF SITE AREAS

Site areas were subjected to two levels of map screening for the identification of potential sites. The screening process initially used the 1:50 000 scale maps, and those site areas which survived this screening were subjected to a more detailed screen at the 1:10 000 scale. This section describes the results of the application of transportation factors to site areas at both 1:50 000 and the 1:10 000 scale level.

Appendix E summarizes the transportation attributes of all the site areas at both scales. The site areas surviving the 1:50 000 scales screen were evaluated through a more detailed constraint analysis carried out with 1:10 000 scale maps.

Table II-7 lists all of the site areas which contain transportation constraints and were eliminated at the 1:50 000 scale screening process.

The surviving sites were analyzed and ranked according to their site vicinity constraints and their relative regional transportation costs and accident probability. Table II-8 lists the surviving site areas according to the three levels of site area constraints:

1. Low site area constraints
2. Moderate site area constraints
3. Severe site area constraints

There were five major considerations in dividing the site areas into these categories:

1. Smoke stack constraints (restriction imposed by airports)
2. Regional road or highway closures required
3. Site area crossed by a railway line
4. Utility transmission lines crossing site
5. Local road closures required

If a site area had none of these constraints or only local road closures, it was placed into the "low" site area constraints category. However, a site area with a smoke stack constraint was considered severely constrained unless it was a landfill only site. Similarily a site area which required either major road closures, such as highways or regional roads, or was traversed by a rail line was also severely constrained. Between these two extremes, site areas which required utility transmission lines relocation were considered moderately constrained.

TABLE II-7

SITE CONTAINING TRANSPORTATION CONSTRAINTS AND WERE ELIMINATED AT THE 1:50 000 SCALE SCREEN

	PI Sites	Landfill Sites
Northern Region (includes area A1)		
	PI-7N	LF-5N
	PI-8N	
	PI-9N	
Western Region		
	PI-1W	LF-6W
	PI-4W	
Central Region		
	PI-3C	LF-4C
	PI-4C	LF-5C
	PI-5C	LF-6C
	PI-6C	LF-7C
	PI-7C	LF-10C
	PI-9C	LF-11C
	PI-13C	LF-19C
	PI-16C	LF-20C
	PI-17C	LF-22C
	PI-18C	LF-26C
	PI-23C	LF-27C
		LF-28C
		LF-31C
		LF-32C
Eastern Region		
	PI-23E	LF-5E
	PI-24E	LF-11E
	PI-25E	
	PI-29E	
	PI-32E	
	PI-33E	
	PI-36E	

Since the railway mode of transport will be explored during a later stage of site selection, Table II-8 identifies site areas where rail access is available either across or near the site area. However, there is insufficient data to rank site areas in terms of the opportunity for railway service.

Transportation costs and accident probability factors are not used independently to rank site areas in site area screening. These two factors were combined and applied only on a regional basis during site area screening. Table II-8 indicates, for each intensity of site area constraints, which site areas are associated with regional areas that are relatively poor, fair, good or best in terms of the combined transport costs and accident probabilities. These findings are based on the combination of accident and cost indices developed in site area screening as illustrated in Figure II-1, and contribute to the relative suitability screening of the site areas.

In compiling the transportation ranking of the site area no consideration was given to the size of the area within the site area boundaries which would be required to support the OWMC facilities. Instead, the rankings are based on the characteristics of the entire site area examined at the 1:10 000 screening scale. In selecting potential sites from site areas, the team of consultants review all the constraints to determine which site areas had sufficient constraint free areas to support a LF or PI or integrated site facilities. Therefore, the transportation rankings alone may not be good indicators of the site areas ultimately chosen as potential site.

TABLE II-8
TRANSPORTATION RANKING OF SITE AREAS SCREENED AT 1:10 000 SCALE

Intensity of Site Area Constraints	Relative Regional Transport Costs and Acc. Prob.	SITE AREAS AT EACH CONSTRAINT INTENSITY(1)							
		Landfill/Integrated (LF)				Physical Chemical/Incinerator (PI)			
		North	West	Central	East	North	West	Central	East
LOW	Best	LF-1A1 LF-2A1 LF-1N* LF-2N(3) LF-4N*	None	None	None	PI-3A1 PI-10N PI-11N PI-12N PI-14N PI-15N	None	None	None
	Good	None	LF-2W LF-3W LF-5W* LF-7W LF-10W LF-13W* LF-14W	None	None	None	None	PI-19C	None
	Fair	None	None	LF-12C LF-13C LF-29C LF-30C	LF-2E* LF-4E*	None	None	PI-1C* PI-2C	PI-1E* PI-2E* PI-4E PI-7E* PI-9E* PI-10E* PI-12E* PI-13E* PI-14E* PI-15E* PI-16E* PI-17E* PI-18E* PI-19E* PI-20E* PI-21E*
	Poor	None	None	LF-2C	None	None	None	PI-15C*	None
MODERATE	Best	None	None	None	None	PI-1N* PI-2N* PI-13N	None	None	None
	Good	None	LF-4W	None	None	None	None	None	None
	Fair	None	None	LF-8C* LF-9C* LF-24C*	LF-1E* LF-3E* LF-12E	None	None	PI-21C*	PI-5E* PI-6E* PI-8E*
	Poor	None	None	LF-3C*	None	None	None	PI-26C*	None
SEVERE	Best	LF-3N	None	None	None	PI-1A1 PI-2A1 PI-3N PI-4N PI-5N PI-6N	None	None	None
	Good	None	LF-11W	None	None	None	PI-2W	None	None
	Fair	None	None	LF-1C*(2) LF-18C LF-25C*	LF-6E* LF-7E* LF-8E* LF-9E LF-10E*	None	None	PI-11C* PI-22C* PI-25C	PI-3E PI-11E* PI-26E* PI-27E* PI-30E* PI-31E* PI-34E* PI-37E
	Poor	None	None	LF-15C*	None	None	None	None	None

NOTES: (1) * = rail access available
(2) Severe constraints if used as an integrated site; only moderate constraints as a landfill.
(3) Severe constraints if used as an integrated site; only low constraints as a landfill.

In the ranking of the 90 site areas using the combined factors from the various disciplines, it was important to input the ranking of the site areas in terms of their relative transportation risk. At this stage in the site selection process, the best indicator of the transportation risk was the regional transportation probability index which was based on trips to the seventeen receiver centroids. The index values associated with each of the site areas is shown in Table E-1 in Appendix E.

PART III
IDENTIFICATION OF CANDIDATE SITES
(INITIAL TRANSPORTATION COMPARATIVE EVALUATION)

CHAPTER 15
INTRODUCTION

During the site area screening step factors developed from several disciplines, including transportation, were used to reduce 152 site areas to 16 potential sites which form 17 siting options. In addition to reducing the number of sites, the potential site boundaries and site access routes were more precisely defined. Following this step, there remained the task of identifying a number of candidate site option from the 17 potential siting options.

This portion of the report documents the development and application of various transportation factors which were inputs to the site selection process to identify the candidate sites. The transportation factors developed at this stage are essentially refinements to the site screening factors. These factors were enhanced to apply on a site basis rather than by site areas, and indicators were used to differentiate constraints and opportunities. The transportation factor indicators were applied on three levels: site; site vicinity and regional access.

The Phase 3 Report identifies four application levels: site, site vicinity, access road-local and access road-regional. This was appropriate due to the large number of factors that were developed and applied overall. However, for purposes of the initial comparative evaluation of sites using only the nine transportation factors, the groupings used were site, site vicinity and regional access. Table III-1 shows how the comparative evaluation factors evolved from site area screening to their application at each level. The factor sheets in Appendix F document the factor's significance and application. Appendix H contains 1:10,000 scale plans of the 16 potential sites with the transportation constraints mapped on to each.

As part of the application of these factors on the various levels, a number of factors including transportation factors, were used by the team of consultants to select the preferred route to each potential site. The comparative evaluation includes the comparison of the alternate access as well as the potential sites.

During the comparative evaluation step a number of assumptions were made regarding the treatment processes and transport modes.

For purposes of the initial comparative evaluation it was decided that the evaluation would continue to be made assuming road transport haulage of all special wastes, additives, and reagents. This assumption will be reviewed prior to the detailed evaluation of candidate sites during Phase 4A, in the event that rail transport is proven to produce an advantage.

It was also decided to include the transport of process additives for initial comparative evaluation. Based upon an estimate of material requirements and a limited number of possible source locations, this item was included in the transport cost and accident probability calculations. Process reagents were not included in this analysis as the source sites for these materials were not determined. The requirements for this item should be determined during Phase 4A.

TABLE III-1

DEVELOPMENT OF INITIAL TRANSPORTATION COMPARATIVE EVALUATION FACTORS AND INDICATORS

SITE AREA SCREENING FACTOR	INITIAL COMPARATIVE EVALUATION FACTOR	INDICATORS APPLIED IN INITIAL COMPARATIVE EVALUATION	LEVEL OF APPLICATION[1]
Arterial Roads	- Proximity to arterial roads	- Proximity of site to arterial access route	Site
		- Haul distance from PI to landfill	Site vicinity
	- Proximity to freeways	- Haul distance from 400-series to integrated or PI site	Regional access
	- Local road access	- Length of local access road widening and/or new access road required	Site vicinity
		- Number of at-grade railway crossings	Site vicinity
	- Road closure and/or utility relocation	- Road closure and utility relocations required and length	Site
Utility Transmission Installation	- Same	- Transmission line relocation required, type and length	Site
Railway Lines	- Proximity to rail access	- Availability of rail access to integrated or PI sites	Site vicinity
Airports	- Proximity to Transport Canada controlled airports	- Possible smoke stack conflict with nearby airports	Site vicinity

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1. For purposes of the transportation analysis, only three factor levels are used as opposed to the four levels applied in the Phase 3 Report. Access road-local and access road-regional are combined under the heading regional access.

TABLE III-1
DEVELOPMENT OF INITIAL TRANSPORTATION COMPARATIVE EVALUATION FACTORS AND INDICATORS
(continued)

SITE AREA SCREENING FACTOR	INITIAL COMPARATIVE EVALUATION FACTOR	INDICATORS APPLIED IN INITIAL COMPARATIVE EVALUATION	LEVEL OF APPLICATION[1]
Transportation Costs (receiver centroids)	- Transportation costs (potential sites)	- Tonne-kilometres of haulage from source to receiver sites	Regional access
Probability of Transport Accident	- Accident probability (potential sites)	- Accident frequency value	Regional access
Haul distance between PI and LF sites	- Transportation costs and accident probability	- Tonne-kilometres of haulage and accident frequency	Regional access

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[1] For purposes of the transportation analysis, only three factor levels are used as opposed to the four levels applied in the Phase 3 Report. Access road-local and access road-regional are combined under the heading regional access.

CHAPTER 16

OVERVIEW

The Phase 3 site selection process has three goals listed here in order of priority:

I. Minimization of Risk to Human Health
II. Minimization of Environmental Impacts
III. Minimization of Financial Cost to OWMC

Each goal is attained by meeting the objectives of that goal. A full list of the objectives associated with each goal is shown in the Appendix to the Facilities Development Process - Phase 3 Report, issued in March 1984. This section discusses the transportation-related objectives and how these are achieved through the application of transportation comparative evaluation factors.

There are two objectives associated with the first goal, which were achieved through initial transportation comparative evaluation:

1. To select transportation routes and modes which minimize the likelihood of a release of contaminants during transit.

2. To site facility components to minimize the number of people who might be exposed and/or the duration of that exposure to contaminants along access routes to the site(s) in the event of a release.

As noted in constraint mapping the probability of accidents, derived from the transportation model, is used to meet these two objectives. However, during initial comparative evaluation, the probability of accidents along access routes was applied on a site basis rather than by general site areas as in site area screening, or regionally as in constraint mapping.

To minimize the number of people who might be exposed to the accidental release of wastes, site access routes selected make use of less populated roadway routings, and maximize the use of freeways or arterial roads.

The second goal, minimize environmental impacts, is attained through the following objectives:

1. To minimize conflict with federal provincial, municipal, and native community policies, programs and plans.

2. To minimize conflicts between transportation of hazardous waste to facility components and the use/enjoyment of property along access routes.

3. To minimize conflict between facility-related traffic and local traffic by ensuring access routes provide an adequate level-of-service.

4. To minimize adverse effect on provision and use of public and private community service and facilities.

Conflicts with federal airport policies were minimized during initial comparative evaluation by investigating a site's proximity to Transport Canada controlled airports. The building height restrictions imposed on areas beyond those described in site area screening, were applied when evaluating potential sites.

Conflicts between the transportation of wastes and the use/ enjoyment of adjacent lands was reduced by choosing access routes with minimal accident rates.

In order to ensure that access routes provided an acceptable level of service, the use of arterial roads and freeways was maximized in selecting these routes.

In selecting the appropriate sites, it is also necessary to consider the site's affect on public and private community facilities. The rerouting of transmission lines, closing of roadways and restricting airport activity are ways in which a site may hamper community facilities. Sites which minimized these conflicts are more suitable as candidate sites.

The third goal of Phase 3 is to minimize the financial cost to OWMC. This is achieved through the following objectives:

1. Minimize on-site development costs.
2. Minimize off-site development costs.
3. Minimize transportation operation costs.

On-site transportation development costs include the cost of rerouting transmission lines, road detours or closings, and possible railway connections. These costs could be minimized by selecting sites which do not contain transmission lines or require road closures, and are situated near railway connections.

Off-site transportation development costs include the improvement of local road access, and possible off-site railway connections. By examining these needs, sites can be selected which minimize off-site costs.

Transportation operating costs are represented by the tonne-kilometres of wastes and additives carried to the site. This quantity is dependent on the amount of wastes attracted, and the site's proximity to waste sources, freeways, arterial roads, and possibly railways (railway proximity will be examined in detail during Phase 4A). Sites with lower tonne-kilometre values will also have lower transport operation costs.

CHAPTER 17
SITE ACCESS ROUTE SELECTION

1. INTRODUCTION

As part of the application of transportation factors to the initial comparative evaluations, separate factors were developed to select the preferred site access route from a 400-series highway to each of the 17 potential siting options. This route selection process required information on each alternative route from all of the disciplines involved in site selection. This input was assembled and assessed by the team of consultants in order to determine the preferred route for each of the potential sites. The attributes of the preferred access routes selected for a particular site were also used in the comparison of alternative sites in order to select candidate sites.

For purposes of Phase 3, site access route analysis considered only existing roadways or those committed for completion by the year 1988.

2. TRANSPORTATION ANALYSIS

There were seven indicators of transportation safety used in comparing alternative access routes. Two of these factors applied to the local access routes and the remainder dealt with the regional routes. The following is a list of the indicators used in the comparisons:

A. Local Access Routes

- Proximity of site area to arterial roads
- Number of level railway crossings on local access routes into site

B. Regional Access Roads

- Transport accident frequency measured by the road type accident rate and road link length
- Distance to freeways from site along access routes
- Total number of level railway crossings on access route
- Number of intersections where a turn is required
- Haul distance between PI and LF sites.

In the transportation analysis a local access road was defined as the road which connects the site to a regional road or provincial highway.

The route comparison was carried out for two categories of alternative routes: those to integrated sites, or PI sites, and those between PI and LF sites. Only certain indicators were applied to each of these categories of routes. For routes to integrated or PI sites, all indicators were applied except the haul distance between PI and LF sites. In comparing alternate routes between PI and LF sites local access road indicators and distance to freeways from site were not applied.

The quantity of special wastes and additives, to be hauled over the alternative access routes examined, was determined to be nearly constant. Consequently, it was not necessary to aggregate the tonne-kilometres, only the kilometres travelled over the various road classifications between the selected control point and the site. The surrogate for transportation cost is the total kilometreage travelled over all roads from the common control point adopted for each site access option. The surrogate for accident probability was then calculated as the sum of the products of the route class kilometreage and the five-year average total vehicle accident rate by route class.

2.1 LOCAL ACCESS ROUTES

The two indicators used to compare local access routes highlight the possible transportation safety problem associated with access routes near the site.

Based upon standard roadway design practice, local roads are built to lower standards than arterial roads. Thus, the safe operating speed of the local road and its structural carrying capability is lower in keeping with the reduced design standard. The upgrading of local roads to acceptable arterial road design standards involves a capital expenditure which is proportional to the length of road to be upgraded.

A level railway crossing on a local road is a safety concern. The level of protection at these crossings is normally at the lowest level of control - usually a single railway crossbuck sign. The quality of railway crossing protection to be provided on such roadways, using C.T.C. warrants, is based on road and rail activity levels. Therefore it is unlikely that automatically activated gates, lights and bells, would be warranted at the present level of activity.

The mitigation of both of these local access transportation safety deficiencies will need to be included in the overall cost of the site construction.

2.2 REGIONAL ACCESS ROUTES

One of the transportation indicators applied at the regional access level describes the access between the freeway and local access roads along different access routes.

The transportation accident frequency compares the relative risk of different access routes from a 400-series highway to the site. To calculate this value the distance travelled along a particular class of road is weighted by the average accident rate of that particular road classification. The higher the accident frequency, the greater the possibility of an accident along the route. In some cases where the comparison involves widely separated points of egress from a freeway, a point on the freeway common to all alternative routes is used for the comparison.

Table G-1 in Appendix G shows the development of the accident frequency value.

Three of the remaining four regional access indicators describe the possible traffic safety problems along the access route. The distance from the freeways gives an indication of route's exposure to populations and sensitive land uses. The number of level railway crossings, and intersections where a turn is required, indicate the number of locations where a vehicle hauling waste could be exposed to a slightly more dangerous situation than at other locations on the access routes.

The final indicator, haul distance from PI to LF site, applies only to the alternative access routes between PI and LF sites of a non-integrated site option. The longer the distance between these two components, the greater the risk of a mishap and possible spill of partially solidified wastes.

Table G-2 of Appendix G, summarizes the values of all the indicators applied to the selection of the alternative routes for comparative evaluation.

2.3 NON-INTEGRATED SITES

Non-integrated sites have one common transportation requirement. That is, a need to transport treated special wastes, and other residues from the physical chemical/incinerator site (PI) to the landfill site (LF). In most instances existing roadways were viewed to provide the best opportunity for this inter-site transfer.

A unique opportunity was identified in relation to non-integrated sites PI-27E and LF-1E. The existing ConRail line passes diagonally through PI-27E and along the west side of LF-1E. The straight line distance from the centres of the two sites is some 3000 m. The travel distance along the rail line between the two sites would be approximately 3600 m. Consequently, the minimization of the transfer haul could be achieved by the development of a truck haul route within or flanking the ConRail right-of-way between the two sites. This would be the minium distance haul route when compared with the existing road system haul options.

The consequences of constructing the new road option along the rail line was reviewed in terms of physical and operational suitability. One major difficulty was identified at the point where the ConRail line passes diagonally through the Biggar Road/ Crowland Avenue intersection. The addition of the haul road would further complicate the intersection which has an existing deficiency in vertical alignment limiting the sight distance at the rail crossing. Although the Regional Municipality of Niagara has a plan by which the current deficiency would be ameliorated by raising the profiles of both roadways, the addition of the haul road would only serve to further complicate an already difficult intersection. The only satisfactory means by which all deficiencies could be eliminated would be to grade separate both the rail line and the proposed haul road from the existing intersecting roadways. This would involve a multi-million dollar investment at a location where the warrants for grade separation are not otherwise met.

As a result of these investigations, the new haul route proposal was eliminated and other transfer movement routing options were evaluated.

CHAPTER 18
TRANSPORTATION COST

1. INTRODUCTION

Transportation cost was identified as a site area screening factor in Chapter 12. In the initial comparative evaluation step this factor has been enhanced to facilitate a comparison of potential sites. The enhancements involve: the introduction of the cost of transporting process additives from the additive source to receiver centroids, and the transposition of the receiver centroid data to the potential sites in their vicinity. The procedures and assumption made in applying this factor are discussed in this chapter.

Further work will be done during Phase 4A of the site selection process to secure more detailed information on special waste sources and quantities, the treatment process, and possible alternative transport modes which will lead to refinements in the calculation of the transportation costs.

2. PROCESS QUANTITIES

The treatment of special wastes prior to disposal in a landfill site requires the use of reagents (mainly lime) and additives (cement or fly ash and cement dust). These must be brought to the physical chemical/incinerator site, so they can be introduced at the appropriate time during processing.

2.1 REAGENT QUANTITIES

At this point in the site selection process, insufficient information was available from the facility planning process to identify the quantities and the types of reagents that would be used by OWMC to treat the waste stream. Consequently, the transportation analysis excludes any consideration of reagent quantities that would be required at treatment facilities.

There is also a basic question regarding which transportation mode would be used to transport reagents to the physical/chemical treatment site. If a significant quantity of reagents were purchased in bulk from one producer, there may be monetary advantages in using the rail mode. Further investigations will be necessary during Phase 4A of the site selection process, before these questions can be answered and included in the transportation analysis.

2.2 ADDITIVE QUANTITIES

Additives are used at the physical/chemical treatment site for the solidification of treated wastes prior to landfilling. The quantities of additives required are sensitive to decisions on partial solidification, total solidification and the process materials to be used by OWMC.

For purposes of the initial comparative evaluation analysis it was assumed that full solidification would be selected and that the cement-only process would be adopted. Preliminary calculations based on these assumptions indicate that some 7700 tonnes per annum of cement will be required based on a mixture ratio of 0.3:1. These findings are shown in Appendix I.

3. TRANSPOSITION OF RECEIVER CENTROID DATA TO POTENTIAL SITES

The initial comparative evaluation step approach involves a modification of the approach applied during site area screening. The first modification involves the addition of the solidification additives, discussed in Section 2.2. The second modification involves the transposition of the cluster centroid tonne-kilometre value to the actual location of the potential site. The procedures applied differ for fully integrated and partially integrated sites.

Manual calculations were applied to calculate the quantity of waste and additives hauled to each integrated site. This was accomplished by examining the results of the site area screening step and determining the directional approach and tonne-kilometres hauled. With this information at hand, manual calculations were then undertaken to transpose the cluster centroid quantities and distances to each of the potential sites represented by the centroid. By this means, a unique tonne-kilometre value was established for each of the potential integrated sites. Appendix E contains a table indicating which site areas are associated with each receiver centroid.

A similar procedure was used for non-integrated sites. The transposition was made directly from the centroid to the physical chemical/incinerator site. From each of the physical chemical/ incinerator sites, the effluent from the treatment process must then be hauled to the selected potential landfill site(s). Preliminary analysis of treatment process quantities (Appendix I), indicate that a total of 124 200 tonnes of treated wastes, including solidification additives, must be hauled to the potential landfill site(s). The tonne-kilometres of this transfer were calculated manually, assuming the use of the best haul route available to the landfill site.

To permit the calculation of the tonne-kilometres of additives hauled, it was necessary to review various possible source sites for cement. After considering the entire candidate area, the cement production plant on Highway 2, within the Ingersoll area, was selected as the most representative source site location. It was further assumed that the additive would be transported by truck using bulk haulage equipment and the routes to potential site was selected based on the routing of special waste quantities. The quantity of tonne-kilometres of additives was calculated for each cluster centroid and the results were added to the tonne-kilometres of special wastes transported.

The addition of the tonne-kilometres of haulage required for the assumed quantity of additives, is not a sensitive item with respect to transportation cost or accident probability. The inclusion of additives within this calculation increases the total tonne-kilometreage values by some 4% in both the minimum and maximum site haulage calculations. Consequently, the removal of additive haulage, would not change the ranking of sites with respect to the transportation cost or accident probability factors.

As discussed under reagent quantities, this assumption does not preclude a future decision to use rail to haul cement in larger bulk quantities. Consequently, the assumptions used for the Phase 3 transportation analysis will be reviewed during Phase 4A of the site selection process at which time more refined information on the solidification process will be available.

CHAPTER 19

TRANSPORTATION ACCIDENT PROBABILITY

1. INTRODUCTION

The probability of a special waste vehicle accident along the access route network was used as a factor in site area screening to compare various receiver centroids. In the initial comparative evaluation, this factor is applied to routes carrying special wastes and additives to potential sites. The procedures followed and assumptions made with respect to this factor are discussed in this chapter.

2. APPLICATION OF ACCIDENT PROBABILITY

The accident probability factor is applied in much the same manner as it was when receiver centroids were compared in site area screening. This includes the use of five-year provincial average all-vehicle accident rates per roadway classification and the tonne-kilometres of haulage along each roadway classification. However, during the initial comparative evaluation the actual routes to potential sites, rather than receiver centroids, are used. The tonne-kilometres of haulage over these routes includes both special wastes and process additives; in the case of partially integrated potential sites, it also includes the haulage of treated solidifying wastes from the PI to landfill site.

Section 3 of Chapter 18 explained the methods employed in the calculation of tonne-kilometres of haulage as a proxy for transportation costs. The proxy for accident probability uses the tonne-kilometre value except that the calculation is undertaken with the data stratified into the four route class groupings. The accident probability value is the sum of the products of the tonne-kilometres of haulage by road class and the five-year average all-vehicle accident rate for each road class.

CHAPTER 20

TRANSPORTATION FACTORS INPUT TO INITIAL COMPARATIVE EVALUATION

1. INTRODUCTION

Nine transportation factor inputs were developed for the initial comparative evaluation. These are discussed within this chapter. The factors are:

- Proximity to Rail Access
- Proximity to Arterial Roads
- Site Proximity to Freeways
- Road Closure Requirements
- Local Access Roads
- Proximity to Transport Canada Controlled Airports
- Utility Transmission Installations
- Transportation Costs and
- Probability of Transport Accidents

This chapter provides information on the rationale and significance of all the factors listed above.

A summary of the initial comparative evaluation data is provided in Chapter 21. This includes the ranking of potential sites based on the transportation comparative evaluation.

2. SIGNIFICANCE OF FACTORS IN INITIAL COMPARATIVE EVALUATIONS

The nine factors developed during the initial transportation comparative evaluation are described in the following subsections.

Detailed factor sheets for each of the transportation evaluation inputs are presented in Appendix F. The geographical impact of the factors is shown on the plans of the 16 sites in Appendix H.

2.1 PROXIMITY TO RAIL ACCESS

All of the initial comparative analysis was carried out assuming that all wastes and additives would arrive by road transport vehicles. It is recognized that the transport of special wastes from remote locations, or to transport bulk shipments of reagents or additives to the facility sites could possibly be handled by rail. Thus, the availability of an existing rail line to a physical chemical/incinerator site or an integrated site is viewed to be a positive site vicinity factor. However, at this point in the process no final decision on the use of rail lines has been taken by the OWMC.

2.2 PROXIMITY TO ARTERIAL ROADS

Minimum site development costs for transportation access would likely occur where facility sites are located along existing arterial roads (provincial or regional roads). Where access must be obtained from an existing local service route or a new road constructed from either an arterial road or a local road, road improvements costs would be involved. These improvements are required to accommodate the number and gross weight of vehicles transporting special wastes, additives or reagents to OWMC facilities. The cost of these improvements is viewed to be a low to moderate constraint on the site factor level.

Non-integrated landfill sites necessitate the transfer of treated special wastes from the nearby physical chemical/ incinerator site to the landfill site. As a result, for these siting combinations it was also necessary to determine the local service routes or new roadways required at both of these sites to permit the transfer of treated wastes from the treatment site to the landfill. Where local roads or new roads are required to be upgraded or constructed, additional improvement costs are involved. Depending upon the length of road improvements or new construction required, the cost of the improvements similarly are viewed to be a low to moderate constraint on the site factor level.

2.3 SITE PROXIMITY TO FREEWAYS

From the accident risk viewpoint, there are two advantages to locating sites on arterial roads in close proximity to 400-series routes. The first relates to the minimization of accident frequency rates; while the second relates to the minimization of environmental exposure along access routes. Consequently, site proximity to a freeway is an important factor which is also included in the transport cost and accident probability indices on the regional access factor level.

Of the 17 site combinations analyzed during initial comparative evaluation, only one site is located such that the factor and indicator analysis results are sensitive to an assumption taken in Chapter 7. This relates to the timing of the Highway 406 extension southward to the East Main Street tunnel crossing of the Welland Canal. Without this freeway route extension, there would be a minor increase in the tonne-kilometres of haulage, and a somewhat higher increase in the accident probability index for the site combination of PI-18E/LF-1C. None of the remaining sites analyzed have a similar sensitivity to arterial roadway improvements assumed to be in place by the end of the year 1988.

2.4 ROAD CLOSURE REQUIREMENTS

Landfill sites require land areas of approximately 275 acres (110 ha). Due to the high state of development within the candidate area, regional and local road development, in some instances, produces a grid of lesser dimensions. Consequently, local road closures and utility relocation may be required to meet the site size requirement. The closure of roads and relocation of utilities could be a low to moderate cost factor applied at the site factor level.

Closure of provincial or regional roads was an exclusionary factor.

Where road closures are required to produce a site area of adequate size, local utilities may be adversely affected necessitating relocation. The cost of these relocations is discussed within the text of Utility Transmission Installations, subsection 2.7.

2.5 LOCAL ACCESS ROADS

In the instances where a potential site is not located adjacent to a major arterial road, there will be a need to upgrade local roads which access the site and this may contribute to the cost of site development. The best indicators of the cost of the upgrading are the length of the roadway and the number of level railway crossings required. The cost of these improvements would have a low to moderate affect on the site vicinity factor level.

2.6 PROXIMITY TO TRANSPORT CANADA CONTROLLED AIRPORTS

The Lester B. Pearson International (Toronto) and the Hamilton Civic airports are the only two airports in the study area which are controlled by Transport Canada. These airports have height restrictions above and beyond the 4 km zone of obstruction height restrictions discussed in site screening because Transport Canada's zoning regulations extend up to 15 km beyond the ends of the runways. The effect of this height control at fully integrated and PI sites cannot be determined with assurance as smoke stack height has not been defined. Therefore, a maximum probable height is assumed.

2.7 UTILITY TRANSMISSION INSTALLATIONS

Major transmission lines routed through potential sites constrain a site's size and useability. However, this constraint may be mitigated by relocating the transmission line facilities to an area where their impact is minimized. Such mitigating activities depend on the type, size and alignment of the existing transmission installation. The relocation of transmission lines, including rerouting utilities away from roads to be closed, is applied as a site factor in the initial comparative evaluation process.

2.8 TRANSPORTATION COSTS

Transportation costs increase with distance and quantity of haulage. In the comparative evaluation, this cost is represented by the tonne-kilometres of special wastes and treatment additives hauled to potential PI and integrated sites, and the treated wastes hauled between PI and landfill sites. This regional access factor is considered to be one of the more significant transportation factors.

2.9 ACCIDENT PROBABILITY

The probability of an accident increases with both travel distance increase and the use of lower road classes to transport special wastes. Therefore, potential sites located close to higher roadway classifications, such as freeways, are likely to be superior from a transport safety viewpoint. This factor is considered to be one of the more significant transportation factors on the regional access level.

3. PUBLIC CONCERNS REGARDING TRANSPORTATION FACTORS

Pages A-51 through A-61 of the Facilities Development Process - Appendix to the Phase 3 Report, provides a complete listing of the public consultation meetings undertaken by the OWMC during Phase 3. During these consultations, transportation of special wastes was identified as a major public concern.

In the development of the transportation factors used for initial comparative evaluation, consideration was given to the public comments so that their suggestions and concerns could be addressed to the maximum extent possible during this phase of site selection.

3.1 PROXIMITY TO RAIL ACCESS

The issue of rail access was raised at several public meetings. As a result this factor was developed to assess the viability of a site should the rail mode become a suitable mode for transportation of special wastes, additives or reagents to the potential sites. Although the rail mode was not analyzed at this phase of site selection, it was considered to be a short-term option for bulk shipment of reagents or additives and provides a longer term option for the transportation of special wastes. The longer term option could become viable should it be decided in the future that one or more consolidation station(s) be established on a rail line serving special waste source areas.

3.2 PROXIMITY TO ARTERIAL ROADS

There has been concern expressed with regard to the haulage of special wastes from sources to an OWMC treatment facility. This overlaps a number of factors developed and applied at the regional and site vicinity factor levels. The proximity to arterial roads factor deals with the last component of linkage of the site to the provincial arterial road network. As noted in the Phase 3 Report, this factor is addressed as Access Road-Local and is considered as a human environmental safety consideration. It also is a cost consideration because new access roads from the arterial road system or the upgrading of an existing local road would necessitate a capital investment to carry out the improvement.

During the Phase 3 analysis a preliminary evaluation of alternative site access routes was undertaken and a routing was identified. The results of preliminary route selection were identified for all potential sites as noted in Table III-2 (see Appendix H for potential site maps).

Based upon public discussion occurring subsequent to the release of the Phase 3 Report, individuals have suggested alternative routings. These will be investigated during Phase 4A and carried forward into the detailed comparative evaluation of the candidate sites.

3.3 SITE PROXIMITY TO FREEWAYS

This is viewed to be an important factor and was included as a regional access factor during initial comparative evaluation of potential sites. From the publics perception it is relevant to the human environment - safety, and transportation cost. As with the proximity to arterial roads factor, it was a consideration in the review of alternative site access routes.

The minimization of travel from a 400-series highway by vehicles hauling special wastes is desirable, due to the superior accident experience encountered on the 400-series highways which have wider rights-of-way and grade separated intersections. Most of the other arterial and local routes are characterized by narrower rights-of-way, at-grade intersections (with or without traffic control), and development flanking the right-of-way. These elements were assessed during the preliminary alternative route investigations leading to route selection. These items will be assessed at a greater level of detail during Phase 4A for input to the detailed comparative evaluation of candidate sites.

3.4 LOCAL ACCESS ROADS

The discussion under the proximity to arterial roads factor gives consideration to local access roads serving potential sites. As was noted, local access routes from the arterial road to a site would require upgrading in both a geometric alignment and a pavement structural sense to accommodate heavy truck transport vehicles.

An added element considered is the existance of at-grade rail crossings of local roads which normally are not protected by higher cost warning or control measures, e.g. gates, flashing lights and bells. It was assumed that higher order control devices must be installed on any local access road having an at-grade rail crossing and identified for access to an OWMC site.

3.5 TRANSPORTATION COSTS

Although transportation costs were not developed directly for potential sites, the tonne-kilometres of haulage required was calculated as a surrogate. This value for each site was then indexed so that the percent change in haulage cost is available.

This factor is recognized by the public as a potential constraint for use of an OWMC treatment site; however, the public indicated that transportation safety is a more important factor than transportation cost. Both factors are included in Table III-2 for the initial comparative evaluation of potential sites and a separate ranking is produced for each.

In Table III-3, which summarizes the transportation ranking of potential sites, the transportation cost and accident probability factors were combined to give equal weight to both at the regional access factor level. It is also noted that the regional access factor level is the most important factor level from a transport point-of-view. This approach parallels the public's perception of the importance of transport costs and safety.

3.6 ACCIDENT PROBABILITY

As noted in the prior discussion, the accident probability factor was ultimately combined with transport cost to produce a combined index which provides equal weight for each factor.

Accident probability was not calculated as a frequency rate due to an inadequate database. The surrogate used, based on average accident frequencies by road class, presents a good basis for initial comparative evaluation of potential sites.

3.7 OTHER FACTORS USED

The three remaining factors:

- Road Closure Requirements
- Proximity to Transport Canada Controlled Airports
- Utility Transmission Line Installations

have not been identified as public concerns. All are viewed as site factors in the Phase 3 Report under the Costs/Operations category. All are considered to be low to moderate constraints on a site factor level.

3.8 PHASE 4A FACTORS

Not all of the publics' concerns relating to transportation factors have been addressed during Phase 3. Many of these concerns related to transportation issues associated with the preferred site or sites and will be addressed during Phase 4. This is recognized in the Facilities Development Process Phase 3 Report (March 1984) - Table 7.1. The highlights of preliminary factors identified and to be developed at Candidate Sites are tabulated below:

- Conduct noise impact analysis within the vicinity of sites.

- Determine the amount of truck traffic to be attracted to the OWMC site.

- Analyze transportation risk for each site.

- Select best site access routes.

- Analyze practicality of rail haulage and compare with road haulage.

- Determine transportation improvement costs to serve sites.

- Determine transportation mitigative measures and design monitoring procedures.

A greater level of detail was not required at this time to determine candidate sites.

CHAPTER 21
COMPARATIVE EVALUATION OF POTENTIAL SITES

1. INTRODUCTION

The indicators for the transportation factors identified in Chapter 20 are applied to the comparison of potential sites on three factor levels:

- Site
- Site Vicinity
- Regional Access

The use of three factor levels, as opposed to the four levels discussed in the Phase 3 Report, was discussed in Chapter 15. Considering only the transportation factors used, the three factor levels used herein are deemed appropriate.

This chapter discusses the results of the comparison at each level. These results in themselves cannot be used to select candidate sites for special waste treatment facilties. The selection, as with the earlier steps in the process, requires input from other disciplines. For example, an area with low transportation costs may have high land acquisition costs. The appropriate scaling of the various factors was carried out jointly by the consultants.

2. APPLICATION OF INITIAL COMPARATIVE EVALUATION FACTORS

The initial comparative evaluation factor sheets in Appendix F, identify the rationale for selecting specific indicators to represent the various factors when applying them to the comparative evaluation. Table III-2 describes the transportation factor findings for each of the potential sites in terms of these indicators.

The boundaries of the potential sites shown in Table III-2, differed slightly from the boundaries of the site areas examined in the site area screening process. The site boundaries were refined based on land ownership and additional constraints identified in the beginning stages of initial comparative evaluation.

The indicators are applied at three levels: site, site vicinity and regional access. This separation of levels is used to represent the magnitude of mitigation which may be required to overcome these constraints. The mitigation of site constraints would have less impact than site vicinity or regional access constraints. Similarly, regional opportunities will have larger importance than site opportunities, from a transportation viewpoint.

Only the transportation cost and accident probability indices give a quantitative indication of the relative advantages of one

FACTORS / SITES	LF-4W	LF-11W	LF-10W	LF-3C	LF-8C	LF-9C	LF-3E	LF-1E
SITE FACTORS								
a) Road closures required and length	None	None	None	1.5 km Krick Road (Gravel) 0.6 km Zumstein Road (Gravel)	None	None	None	2.1 km Morris Road (Gravel) 1.3 km Young Road (Gravel)
b) Utility relocations required type and length	None	None	None	1.5 km Hydro along Krick Road 1.2 km Hydro and Bell underground along Zumstein Road	2.0 km of underground Bell cable in site	1.0 km underground Bell cable cuts diagonally through site	0.2 km of IPL pipeline in north end of of site	2.1 km Bell and Hydro on Morris Road 0.9 km Bell and Hydro on Young Road 1.0 km of underground Bell cable in southeast corner of site
c) Proximity of site to arterial access route	0	0	1.4 km to Regional Road 222	3.2 km to Regional Road 27/Schisler Road	1.4 km to Highway 20	0	0	1.7 km to Regional Road 98/ Montrose Road
SITE VICINITY FACTORS								
a) Possible smoke stack conflict with nearby airport	Within 2 km of Burlington Airpark and some local effects possible**	None	None	None	None	None	None	None
b) Length of local access road widening and/or access road required	Possible need to upgrade 3.2 km of Fourth Line	None	Upgrade 1.4 km Butter Road	Upgrade 3.2 km Elcho Road	Upgrade 1.4 km of Gee Road	None	None	None
c) Number of at-grade rail crossings on local access route to site	None	None	None	None	None	None	None	None
d) Availability of rail access to integrated site	1.0 km from CN Rail, arterial road crossing required (Tremaine Road/ RR 22)	None	None	0.3 km from TH & B; arterial road crossing required (Regional Road 16)	2.0 km from TH & B; road crossing required (Vaughan Road East)	1.5 km from TH & B; arterial road crossing required (Highway 20)	ConRail adjacent; road crossing required (Crowland Avenue)	ConRail adjoins site
REGIONAL ACCESS FACTORS								
a) Haul distance from 400 series to integrated site	11.2 km to Highway 401 14.3 km to QEW	5.6 km to Highway 403 E 16.0 km to Highway 403 W	9.6 km to Highway 403 E 20.0 km to Highway 403 W	32.0 km to QEW	21.9 km to QEW	21.7 km to QEW	2.1 km to QEW	3.6 km to QEW
b) Transport Cost Index and (Tonne-kilometres of haulage from source to receiver sites-in millions)	1.00 (24.99)	1.07 (26.81)	1.09 (27.20)	1.26 (31.40)	1.28 (32.02)	1.28 (32.11)	1.42 (35.47)	1.44 (36.03)
- ranking of 17 site options* and (% increase from minimum value)	1 (0)	4 (7)	5 (9)	11 (26)	12 (28)	13 (28)	15 (42)	17 (44)
c) Accident Probability Index	1.00	1.22	1.29	1.50	1.45	1.47	1.32	1.42
- ranking of 17 site options* and (% increase from minimum value)	1 (0)	3 (22)	6 (29)	17 (50)	15 (45)	16 (47)	7 (32)	13 (42)
d) Composite Index	1.00	1.15	1.19	1.38	1.37	1.38	1.37	1.43
- ranking of 17 site options*	1	3	5	13	11	13	11	17

* Applies to both integrated and partially integrated options.

** Burlington Airpark is not a controlled airport.

TABLE III -2
INITIAL TRANSPORTATION COMPARATIVE EVALUATION OF POTENTIAL SITES - INTEGRATED SITES

FACTORS / SITE COMBINATIONS	PI-1N/LF-4N	PI-13N/LF-4N	PI-1A1/LF-2N	PI-2W/LF-11W	PI-2W/LF-10W	PI-13N/LF-2N	PI-1N/LF-2N	PI-18E/LF-1C	PI-27E/LF-1E
SITE FACTORS									
a) Road closures required and length	None; First Line Road at PI site does not require closure	None	None	None	None	None	None; First Line Road at PI site does not require closure	LF-1C: 1.3 km Deeks Road PI-18E: None	PI-27E: None LF-1E: 2.1 km Morris Road (gravel) 1.3 km Young Road
b) Utility relocations required type and length	LF-4N: None PI-1N: SunOil Pipeline thru site in an east-west direction	None	LF-2N: 230 KV line on site PI-1A1: None	LF-11W: None PI-2W: 230 KV and 500 KV Hydro lines thru site	LF-10W: None PI-2W: 230 KV and 500 KV Hydro lines thru site	LF-2N: 230 KV line on site PI-13N: None	LF-2N: 230 KV line on site PI-1N: SunOil Pipeline thru site in an east-west direction	LF-1C: 0.2 km of Bell and Hydro on Deeks Road PI-18E: None	LF-1E: Bell and Hydro on Morris Road (2.1 km) Bell and Hydro on Young Road (1.3 km) Underground Bell (1.0 km) in southeast corner PI-27E: IPL in southwest corner 115 KV Hydro line diagonally thru site
c) Proximity of site to arterial access route (applies only to PI sites)	0	0.4 km to Britannia Road	0	1.6 km to Highway 2	1.6 km to Highway 2	0.4 km to Britannia Road	0	0	0
SITE VICINITY FACTORS									
a) Possible smoke stack conflict with nearby airport (applies to PI site)	Some affect on local navigation possible	None	None	70 m ± maximum height	70 m ± maximum height	None	Some affect on local navigation possible	None	None
b) Length of local access road widening and/or access road required	Possible need to upgrade 3.2 km of Fourth Line Road	Possible need to upgrade 3.2 km of Fourth Line Road	None	PI-2W: 1.4 km of Shaver Road to be upgraded	PI-2W: 1.4 km of Shaver Road to be upgraded	Possible need to upgrade 3.2 km of Fourth Line Road	Possible need to upgrade 3.2 km of Fourth Line Road	PI-18E: None LF-1C: 0.7 km of O'Reilly's Road to be upgraded	PI-27E: None LF-1E: 1.7 km of Carl Road to be upgraded
c) Number of at-grade rail crossings on local access route to site	None	None	None	None	None	None	None	PI-18E: None LF-1C: 1 CN single track	None
d) Availability of rail access to PI site	CNR adjacent	None	None	None	None	None	CN line adjacent	ConRail and CN line on site	ConRail on site
e) Haul distance from PI site to landfill site (km)**	1.0	7.8	15.0	6.0	10.0	27.1	28.0	12.1	3.7
REGIONAL ACCESS FACTORS									
a) Haul distance from 400 series to PI site	8.6 km to Highway 401 10.4 km to QEW	7.7 km to Highway 401 12.4 km to Highway 403 14.9 km to QEW	19.0 km to Highway 401 14.5 km to Highway 410	14.5 km to Highway 403 W 2.1 km to Highway 403 E	14.5 km to Highway 403 W 2.1 km to Highway 403 E	7.7 km to Highway 401 12.4 km to Highway 403 14.9 km to QEW	8.6 km to Highway 401 10.4 km to QEW	11.5 km to Highway 406 existing 3.4 km to Highway 406 proposed	1.0 km to QEW
b) Transport Cost Index and (Tonne-kilometres of haulage from source to receiver sites - in millions	1.01 (25.30)	1.06 (26.48)	1.09 (27.34)	1.12 (27.87)	1.13 (28.21)	1.14 (28.53)	1.16 (28.94)	1.41 (35.16)	1.42 (35.57)
- ranking of 17 site options* and (% increase from minimum value	2 (1)	3 (6)	6 (9)	7 (12)	8 (13)	9 (14)	10 (16)	14 (41)	16 (42)
c) Accident Probability Index	1.05	1.28	1.35	1.36	1.42	1.34	1.26	1.41	1.34
- ranking of 17 site options* and (% increase from minimum value	2 (5)	5 (28)	10 (35)	11 (36)	14 (42)	9 (34)	4 (26)	12 (41)	8 (34)
d) Composite Index	1.03	1.17	1.22	1.24	1.28	1.24	1.21	1.41	1.38
- ranking of 17 site options*	2	4	7	8	10	8	6	16	13

* Applies to both integrated and partially integrated options.

** Shown for informational purposes only; not used in site selection.

TABLE III-2
INITIAL TRANSPORTATION COMPARATIVE EVALUATION OF POTENTIAL SITES - PARTIALLY INTEGRATED SITES (continued)

site over another. A larger number indicates a higher cost or a greater possibility of an accident along the routing network. For comparison purposes the table shows the percentage increase in these values with respect to the site having the minimum value. It should be noted that these are only approximate values which maybe enhanced during Phase 4A when access route data can be refined as indicated in Section 3.8.

The information presented in Table III-2 also permits a relative comparison of transportation costs based on the special wastes and additives transported. For example, a comparison of the tonne-kilometres hauled for the site producing the minimum value of 24.99 million tonne-kilometres (site LF-4N) with the site producing a maximum value of 36.06 (LF-1E), the percent increase in transport is 44%. It can therefore be concluded that the cost of transportation is 44% higher at site LF-1E than at site LF-4N. Using the very approximate costing value of $1.0 million increase in annual transportation hauling costs, based on current dollars, for each 25% increase in tonne-kilometres, the difference between the transport costs of the two extremes is estimated to be about $1.9 million.

By comparing the accident probability index value for any two site options, the percent increase in accident risk can be determined. For example, the non-integrated site option PI-27E/LF-1E has an index of 1.34; the difference between this number and the index at site LF-3C (1.50) is 0.16. Therefore, the probability of a transport accident using site LF-3C is over 12% (0.16÷1.34x100) greater than using PI-27E/LF-1E.

The accident index numbers recorded in Table III-2 cannot be used to determine the number of accidents that would likely occur. For the reasons discussed earlier, no accurate estimate of numbers of transporting vehicles can be made. It is expected that this refinement will occur during Phase 4B of the site selection process. In the interim, the accident probability index and ranking provides a surrogate value for accident probability and was used in the initial comparative evaluation.

3. RANKING OF POTENTIAL SITES

The ranking of the potential sites in this report reflects only the sites' attributes from a transportation viewpoint. These rankings cannot realistically be applied by themselves to select candidate sites; they must be considered in conjunction with the site factor rankings provided by other disciplines and appropriate trade-offs carried out to identify the best overall sites.

The sites were ranked according to their attributes at each level of factor influence (i.e. site, site vicinity and regional access). From a subjective viewpoint, the regional access is the most important level for transportation factors, followed by site vicinity and site factors. Due to the insufficient amount of data available at this time, no attempt has been made to rationalize the degree of importance each of these levels has over the other; however, relative importance of the indicators used at each factor level was used to rank the site options within each of these levels.

Table III-3 summarizes the methodology involved in using the contents of Table III-2 to rank the site options within each factor level. The following text documents the rationale used in applying the indicators to the potential sites. The results of this ranking process are shown in Table III-4.

TABLE III-3
TRANSPORTATION FACTORS: RANKING OF IMPORTANCE

SITE FACTORS		SITE VICINITY FACTORS*		REGIONAL ACCESS	
Low	= no constraints	Low	= no constraints	Low	= composite index range 1.0 to 1.03
Moderate	= 1-2 constraints	Moderate	= local road improvements or rail crossing required	Moderate	= composite index range 1.15 to 1.28
High	= 3 constraints	High	= local road improvement and level rail crossing required	High	= composite index range 1.37 to 1.43
		Very High	= possible airport conflict due to stack height		

* Availability of Rail Access not ranked as this is identified as an opportunity which may or may not be significant.

The ranking of site options in terms of the site factors depends upon the constraints imposed by the factors at a given level. There are three constraint indicators at the site level: road closures, utility relocation and proximity to arterial roads (indicates length of road which will need to be improved near the site). A site with no constraints in any of these areas would fall into the LOW category in Table III-4. Sites constrained by all the indicators would be in the HIGH category and those with one to two constraints would be MODERATE.

Site vicinity factors are not treated equally as with site factors. There are three indicators considered on this level: smoke stack conflicts, local road improvements, rail access. Two of the indicators from Table III-2 are combined or dropped. Local roads and level rail crossings are dependent and are therefore considered together as local road improvements. Travel distance to landfill, which applies only to partially integrated sites, is more appropriately considered in transport costs at the regional access level.

Potential sites are divided into VERY HIGH, HIGH, MODERATE or LOW categories according to the constraints imposed by the site vicinity factors. Since there is insufficient data at this time to assess the value of a site's proximity to rail access, it has been treated as a possible opportunity, depending upon accessibility. Railway proximity was not used in the ranking of the sites, except as a footnote indicating which sites have good rail accessibility. Smoke stack conflict is the indicator of airport proximity; sites with this constraint are immediately put into the VERY HIGH category since their useability may be greatly restricted. Sites requiring only local road improvements are put into the MODERATE group and if an at-grade rail crossing is also involved the site is assigned to the HIGH group. Sites with no constraints are put into the LOW category in the table.

TABLE III-4
TRANSPORTATION RANKING OF POTENTIAL SITES OPTIONS AT EACH FACTOR LEVEL

FACTOR LEVEL	POTENTIAL SITES AT EACH CONSTRAINT INTENSITY LEVEL			
	LOW	MODERATE	HIGH	VERY HIGH
Site	LF-4N LF-11W	PI-1A1/LF-2N PI-13N/LF-2N PI-13N/LF-4N PI-1N/LF-4N PI-1N/LF-2N PI-2W/LF-11W PI-2W/LF-10W PI-18E/LF-1C PI-27E/LF-IE LF-10W LF-8C LF-9C LF-3E	LF-3C LF-1E	
Site Vicinity	PI-1A1/LF-2N LF-11W LF-1E (1)	PI-13N/LF-4N PI-13N/LF-2N PI-1N/LF-2N (1) PI-1N/LF-4N (1) PI-27E/LF-1E (1) LF-4N (2) LF-10W LF-3C (2) LF-8C (2) LF-9C (2) LF-3E (2)	PI-18E/LF-1C(1)	PI-2W/LF-11W PI-2W/LF-10W
Regional Access	PI-1N/LF-4N LF-4N	PI-1A1/LF-2N PI-13N/LF-4N PI-13N/LF-2N PI-1N/LF-2N PI-2W/LF-11W PI-2W/LF-10W LF-11W LF-10W	PI-27E/LF-1E PI-18E/LF-1C LF-8C LF-9C LF-3C LF-1E LF-3E	

NOTES - Under site vicinity factors:

(1) Indicates that a railway line is in close proximity to the integrated LF site or the PI site for a non-integrated option.

(2) Indicates that a railway line connection would require a road crossing

The regional access level factors are the most important factors from a transport point of view. At this level, two indicators are combined to rank the sites: transportation costs and accident probability. The combined affect of cost and accident probability for a site option is the mean of the two indices. The proximity to 400-series highways indicator is also considered within the calculations for transport cost and accidents. Sites are allocated to the appropriate category in accordance to the combined affect of costs and accidents. In examining the composite index for each of the potential sites, it was apparent from Table III-2 that the sites were closely grouped together into three ranges cf increases. There were two sites between 1.C and 1.03, eight sites between 1.15 and 1.28, and the remainder between 1.37 and 1.43. Therefore, the sites were assigned to LOW, MODERATE and HIGH according to these three ranges, respectively.

4. CONCLUSIONS

The ranking of the potential site options provides a basis for selecting which site options are the most suitable from a transportation standpoint. However, these conclusions must be interpreted in light of the conclusion reached by other disciplines before selecting candidate sites.

There is inadequate transportation data at this point to select one specific site option as being superior to the others; however, it is possible to indicate groups of site options which are potentially more suitable for candidate sites than others, based on their ranking at each factor level and the importance of each level. Since the regional access factors have been identified as the most important factors, it is appropriate to choose site options which rank high in this category; however, the influence of site vicinity and site factors may alter their apparent superiority. Table III-5 documents the site options selected for each category.

Two site options have emerged superior in terms of regional access, with low or moderate constraints at the other levels and both with potential railway access. Based on discussions with Transport Canada staff, the integrated potential site option LF-4N (with a maximum 100 m high incinerator smoke stack) should have only minimal operational impact on the operations of the Burlington Airpark. The partially integrated site option of PI-1N/LF-4N avoids any airport conflict by using site LF-4N as a landfill site, and the minor pipeline constraint near the north border of the site does not pose a major threat to locating facilities within the site boundaries. Therefore the following two site options are rated as "most suitable" in Table III-5.

- LF-4N
- PI-1N/LF-4N

There are eight site options with moderate constraints at the regional access level; LF-11W, and PI-1A1/LF-2N have low site vicinity constraints, PI-13N/LF-4N, PI-1N/LF-2N, PI-13N/LF-2N, LF-10W have moderate site vicinity constraints (PI-1N/LF-2N also has a rail opportunity). PI-2W/LF-10W and PI-2W/LF-11W have very high constraints at the site vicinity level and are listed as "least suitable (without a rail opportunity)" in Table III-5. Five of the six site options with low or moderate site vicinity constraints have moderate site constraints; LF-11W has low site constraints. These six site options are ranked as "moderately suitable" as candidate sites in Table III-5, and are listed below:

TABLE III-5
OVERALL RELATIVE TRANSPORTATION RANKING OF POTENTIAL SITE OPTIONS

RANKING CATEGORY	SITE OPTIONS INTEGRATED	 PARTIALLY INTEGRATED
Most suitable	LF-4N(2)	PI-1N/LF-4N (1)
Moderately suitable	LF-10W LF-11W	PI-13N/LF-4N PI-1N/LF-2N (1) PI-13N/LF-2N PI-1A1/LF-2N
Least suitable (with rail opportunities)	LF-3C (2) LF-8C (2) LF-9C (2) LF-1E (1) LF-3E (2)	PI-27E/LF-1E (1) PI-18E/LF-1C (1)
Least suitable (without rail opportunities)		PI-2W/LF-11W PI-2W/LF-10W

NOTES:

1. Indicates that a railway line is in close proximity to the integrated LF or the PI site in a non-integrated option.
2. Indicates that a railway line connection would require a road crossing.

- PI-13N/LF-4N
- LF-10W
- PI-1N/LF-2N (rail opportunity close to PI site)
- PI-13N/LF-2N
- LF-11W
- PI-1A1/LF-2N

There are seven site options with high regional access constraints. However, LF-3C, LF-8C, LF-3E, LF-9C, LF-1E, PI-27E/LF-1E, and PI-18E/LF-1C have potential railway opportunities: LF-1E has low site vicinity constraints, and the remainder have moderate or high constraints. LF-1E also has high site constraints. Of the six remaining site options, with rail opportunities, LF-3C has high, and the rest have moderate site constraints.

Should the railway mode be identified as a supportive or alternative transport mode, all seven of these site options may improve at the regional access level. These have been ranked as "least suitable (with rail opportunities)" in Table III-5:

- LF-3C
- LF-8C
- LF-3E
- LF-9C
- PI-27E/LF-1E
- LF-1E
- PI-18E/LF-1C

Further site selection analysis to be carried out in Phase 4A may alter the ranking of these site options. Should this occur, the site options will be re-examined and appropriate alterations in ranking will be made.

REFERENCES

1. Aeronautical Standards and Legislation Branch, Ministry of Transport, Aerodome Standards, Physical Characteristics, and Obstacle Limitation Surfaces, Revised July 1976.

2. Ibid, S.4.3.2.

3. Ibid, S.4.4.1.

4. Shaw, T., F. Pilorusso and G. Beech, Transportation of Special Wastes in Ontario (prepared for OWMC by Pilorusso Research Assoc. Inc.) September 1983.

5. Proctor and Redfern Group. 1982. Waste Quantities Study. Prepared for Ontario Waste Management Corporation, Toronto, Ontario.

6. Steers, Davies and Gleave Limited. MOTORS Transportation Package User Manual.

APPENDIX A

FACTOR SHEETS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** ARTERIAL ROADS

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR: Arterial roads are intended to carry large volumes of all types of traffic moving at relatively high speeds. Freeways and expressways are arterial roadways but having full and partial access control, respectively.

The Highway 400 series routes and the QEW are freeway facilities, whereas the balance of the provincial road series and the upper tier regional road systems are of the normal arterial type.

RATIONALE/SIGNIFICANCE: The arterial road system across the Province is viewed as the most logical system for the transport of special wastes from source to receiver sites. Maximum use of the freeway network is desirable due to the more favourable accident statistics exhibited on freeways. Proximity of an OWMC facility site to an arterial road is a desirable feature. Remoteness from an arterial route will increase site development cost due to the need to upgrade lower class roads or construct a new facility.

SOURCES OF INFORMATION: The 1982-83 Provincial Road Map provided basic system information. Regional road details were also determined from Regional Road Maps. Information on arterial road upgrading was identified from the MTC report, Future Perspective Provincial Highways 1981-2001, prepared by the Highway Program Development Branch. Emphasis was placed on short-term improvements, i.e. projects proposed for implementation on or before 1988, which was assumed to be the probable opening date of OWMC facilities. All provincial road projects for the construction of new freeways or the upgrading of arterial roadways to expressways were identified and were then reviewed with representatives of the MTC Capital Programs Section and/or the regional road agencies having project jurisdiction. Only those projects which had advanced sufficiently towards the final design stage were assumed to be available by 1988 for inclusion in the provincial network.

Within the candidate areas, the following list of road improvement projects were assumed to become available:

- Highway 410 extension from Steeles Avenue to just north of Highway 7
- Highway 406 extension northwards through St. Catharines to the QEW
- Highway 406 extension southwards from Merritt Road to a connection with the East Main Street Tunnel.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** ARTERIAL ROADS

INTERPRETATION/METHODOLOGY: The arterial system serving all candidate areas has been plotted on the OWMC 1:50 000 base map series. Distinctive legends are used to differentiate between freeways, other provincial roads and regional roads. Interchange connections are also identified. The arterial road systems shown are those that are assumed to be available to provide transportation service by the year 1988.

CRITERIA/INDICATORS: Candidate areas which are conveniently served directly from the arterial road network are preferred. Those areas which minimize travel distance from the freeway network have superior service.

Areas which are not linked directly to the arterial road system would require either:

- upgrading of existing non-arterial roadways to arterial standards, or construction of a new arterial road link to serve the area

The cost of upgrading existing roads or constructing new arterial links could be a constraint and is measurable.

COMMENTS/ASSUMPTIONS/LIMITATIONS: Most of the arterial road system is in-place and available to serve an array of sites. Three projects within the candidate areas (see Source of Information) were identified and these are assumed to become available prior to 1989. Two of these projects are under final design or implementation. The third project (Highway 406 southward extension) is under environmental review.

No analysis of road safety characteristics has been completed at this time. This will be undertaken for all transportation routes identified during the detailed comparative evaluation of sites.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** RAILWAY LINES

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: Includes all active railway lines as well as abandoned lines within candidate areas.

RATIONALE/SIGNIFICANCE: The location of rail lines is relevant to property assembly and the possible use of rail lines as transportation corridors. Thus, may be relevant to all facility types for either the conveyance of special waste or reagents required at physical/chemical treatment site and solidification sites.

Land assembly for facilities may be influenced by location of railway property. It is unlikely that OWMC facilities would straddle an existing rail line although it could be desirable to flank a rail line. The rationale is that rail service provides an opportunity for transportation of special waste, additives or reagents, although at this time the quantities and/or haulage distances do not appear to favour railway transport.

SOURCES OF INFORMATION: Four railway properties cross the candidate areas. These include CNR, CP Rail, T.H. & B and ConRail. Other railways operate within the territory but by agreement with one of the four railways identified.

- Existing rail lines from the OWMC 1:50 000 base mapping

- Contacts with CN Rail, CP Rail, T.H. & B and ConRail in August 1983

INTERPRETATION/METHODOLOGY: Existing railway lines are to be mapped with the following distinctions:

- active rail lines (currently in use)

- abandoned rail lines (not used)

Active rail lines provide interconnection with the national railway network. Special consideration of abandoned rail lines is necessary in that severance of these lines may have occurred in whole or part, due to other major construction activities, e.g. construction of the Welland Canal by-pass. The abandoned rail lines do retain the connections as shown and based on information that was secured from the owners.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** RAILWAY LINES

CRITERIA/INDICATORS: None required as physical presence is the basic requirement to serve the candidate areas. Proximity of sites within the candidate areas to active rail lines is the basic indicator. Where existing rail lines adjoin sites, rail service is assumed to be readily available. If a spatial separation exists, it would be necessary to secure a new right-of-way and construct a rail spur line. This would introduce a cost constraint which would be variable, depending upon the length and topographic features between the site and the rail line.

COMMENTS/ASSUMPTIONS/LIMITATIONS: It is important that site location in relation to the railway lines protect for the future continuity of the railway ROW back to an existing operating rail line. Consequently, an assumed use of an abandoned rail line entails a risk of severance of the line by the owner, unless early action is undertaken by the Corporation to inform the Railway of the desirability for the reinstitution of rail service on the line in question.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** UTILITY TRANSMISSION INSTALLATIONS (OUTSIDE ROAD ALLOWANCES)

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: Includes the following facilities: Ontario Hydro transmission lines, oil and gas pipelines, trunk water and sanitary services, Bell Canada cables.

RATIONALE/SIGNIFICANCE: Siting of OWMC facilities should avoid conflict with existing utilities and services. No conflict will exist between these utilities and the proposed OWMC facilities provided an adequate spatial separation exists. The required spatial separation may vary for different types of utilities. Potential conflicts may be mitigated by transmission line relocation in some instances.

SOURCES OF INFORMATION:

- 1:50 000 base mapping prepared for OWMC from standard topo sheets (Surveys and Mapping branch, Department of Energy, Mines and Resources)

- information confirmed by letters, mapping and/or visits to:
  - . Ontario Hydro - visit 19 August 1983
  - . Consumers Gas - letter 16 June 1983
  - . TransCanada PipeLine - letter 14 June 1983
  - . Bell Canada - visit 18 August 1983
  - . Ministry of the Environment (Peel Region, South West Region (Hamilton) visit 18 August 1983
  - . Peel and Halton Regions - visit 16 September 1983
  - . Niagara Region - visit 16 September 1983
  - . Union Gas - letter 17 June 1983
  - . Inter-Provincial - letter 15 June 1983
  - . Sun Canadian - visit 17 August 1983
  - . Hamilton-Wentworth Region - visit 18 August 1983

INTERPRETATION/METHODOLOGY: Using all sources identified, the location of each transmission service within the candidate areas is to be mapped; number and sizes of trunk services to be identified where practical and useful, including width of easement(s) if available.

Preliminary information was secured by letter or telephone poll, generally followed up by visit to the individual agencies to collect detailed information regarding location and sizing of trunk facilities.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING:	**FACTOR:**
TRANSPORTATION	UTILITY TRANSMISSION INSTALLATIONS (OUTSIDE ROAD ALLOWANCES)

CRITERIA/INDICATORS: Physical presence is the basic indicators. Size and number of facilities and width of easement, where possible, will be indicated on maps.

COMMENTS/ASSUMPTIONS/LIMITATIONS: Size and type of facility reflects the cost of mitigation (e.g. by relocation of facility).

Reasonable effort has been made to locate all cross country facilities in the candidate areas. However, an inordinate amount of field investigation would be required at this stage to ensure that every facility has been identified. Confirmation of all cross-country facilities will be more practical when the site selection process is narrowed down to a few priority sites.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** AIRPORTS

FACILITY COMPONENTS AFFECTED: All, but to varying degrees - incinerator site has major control, followed by physical/chemical treatment and landfill due to the variability of assumed height obstruction.

DEFINITION OF FACTOR: Airports within the candidate areas could be affected by construction of OWMC facilities. The flight paths over the ground approach to these airfields could be in conflict with the height of physical structures required on an OWMC site(s). This in turn may affect the airport license and/or operation.

RATIONALE/SIGNIFICANCE: Obstacle control protection exists at Lester B. Pearson International and Hamilton Civic as defined by Transport Canada Regulations (see Aerodrome Standards Amendment No. 2 of the Aeronautical Standards Legislation Branch). This regulation prohibits vertical obstructions exceeding 45 m within a radius of 4000 m from a theoretical reference point(s) at each airport. The reference point(s) are located as near as practical to the geometric centre of individual landing areas with adjustment for future development.

Within the 4000 m radius, more restrictive vertical controls exist. These are oriented with respect to the individual runways and are most restrictive off the ends of the runways as opposed to the transverse edges of the runways.

All other airports located within the mapped coverage of the candidate areas do not enjoy obstacle control protection. However, infringement within the theoretical control areas could adversely affect the license or the operation of these airfields and thus would impact the present use.

SOURCES OF INFORMATION: Control data on obstacle limitation surfaces is published by the Aeronautical Standards and Legislature Branch of the Ministry of Transport (see Aerodrome Standards Amendment No. 2). Airport location data is shown in Ontario Airport Facilities Map 1981-82 Transport Canada, VFR Supplement; and Airstrip Charts by the Ontario Flying Farmers. Airport locations identified were also cross checked with the Ministry of Transportation and Communications 1981/82 map, Ontario Airport Facilities.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING:	**FACTOR:**
TRANSPORTATION	AIRPORTS

INTERPRETATION/METHODOLOGY: The Transport Canada publication (Aerodrome Standards Amendment No. 2) presents specific information for the calculation of the location of vertical obstacles of various heights and where these are acceptable. These calculations were made for an assumed 30 m high physical/chemical treatment facility and a 20 m high solidification/landfill site development. This information is plotted on 1:50 000 OWMC overlays for the two controlled airports, as well as for other airports where no formal control exists.

For the Lester B. Pearson and Hamilton Civic airports, the controls identified are exclusionary. For all other airports, the controls are considered to be constraints as they could affect licensing or operations.

CRITERIA/INDICATORS: For the Hamilton Civic and Lester B. Pearson Airports, the obstacle controls are rigid and it can be considered an exclusionary factor.

For all airports, irrespective of the lack of control regulations, the procedure applied was:

- locate the airport reference point(s) and define the external limits of the 4000 m outer surface within which a vertical obstruction exceeding 45 m is prohibited
- define within this area the boundaries for an obstruction height of 30 m and 20 m based on the take-off approach surface requirements and longitudinal height controls

These calculations were undertaken as described in the Aerodrome Standards publication of Transport Canada.

COMMENTS/ASSUMPTIONS/LIMITATIONS: Certain of the minor non-controlled airport facilities are identified only with the Ontario airport map. Consequently, the location of runways could not be determined. Thus, only the 4000 m radius circle surrounding the specified sites could be located and other control surfaces were omitted due to the lack of a reference point.

All control surfaces identified are subject to adjustment and/or interpretation by Transport Canada staff. Their proposal was that if OWMC sites are identified within proximity to any airport, that the situation be referred back to them for an intepretation of the degree of conflict and effects on airport license or operation. The decision to assume the 20 m and 30 m height limitations in relation to physical/chemical treatment and solidification plant sites was based upon an analysis by the facility consultant. These vertical height assumptions have been accepted by OWMC staff at this stage in site identification but subject to future detailed study.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	AIRPORTS

COMMENTS/ASSUMPTIONS/LIMITATIONS: (continued)

From the detailed plotting of the airport factor data on overlays to the OWMC 1:50 000 base mapping, the following observations arise:

- the easterly edge of candidate area 14 is affected by the Lester B. Pearson International Airport 4000 m control circle

- the northerly portion of candidate areas 6 and 16 are affected by the Hamilton Civic Airport 4000 m control circles. Area 6 also intrudes slightly within the 20 m and 30 m control surfaces.

SEPTEMBER 1983

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	TRANSPORT COSTS

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: Assuming road transport of special wastes and process additives by trucks, the distance travelled and total annual loadings from source sites to alternative receiver sites provides an indicator of transportation system efficiency and transport cost. The measurement used will be tonne-kilometres.

RATIONALE/SIGNIFICANCE: The lack of precise information on waste stream, containerization, transfer and consolidation station, destinations for each waste stream by facility type and types of vehicles necessary to accommodate the shipments, prevents a detailed assessment of transport cost. Transportation cost will become an important factor during site selection. These were quantified on a preliminary basis for assumed locations at between $5 million and $8 million.

To provide a relative index of transportation efficiency which is indicative of cost, the total annual tonne-kilometres of travel from each of the defined generator source areas to the alternative receiver cluster centroid was determined. This calculation assumed the transportation of 150 000 tonnes/annum of special wastes from the 43 municipal source sites to each receiver cluster centroid.

SOURCES OF INFORMATION: The inputs required to undertake the analysis included:

- minimum time and/or distance routings developed for the provincial network;
- waste quantity distribution developed by OWMC for a 150 000 tonne/annum scenario based upon the Waste Quantities Study Report;
- tonne kilometres of haulage from each municipal waste source site to the seventeen receiver site cluster centroids;
- local road systems and arterial road systems developed as a part of the arterial roads factor.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** TRANSPORT COST

INTERPRETATION/METHODOLOGY: The selected routings for each cluster centroid analysis was combined with the tonnes to be hauled from each source site to the centroid using the "MOTORS" transportation planning model. The product of this analysis was the tonne-kilometres hauled per annum by road type classification from all source sites to each cluster centroid.

The transport cost index was combined with the accident probability index to derive a composite index for use in Constraint Mapping.

CRITERIA/INDICATORS: The indicator used was the total annual tonne-kilometres hauled to the general candidate region composed of candidate areas. This acts as an indicator of the cost of haulage to these regions. When combined with the accident probability, this produces a composite factor for mapping regions of relative transport access.

COMMENTS/ASSUMPTIONS/LIMITATIONS: The tonne-kilometres of transportation haulage for the 150 000 tonnes/annum scenario is viewed to be a valid comparison of transportation haulage (cost). The comparison produces a somewhat lower value than actual and for the following reason:

- Some 2% of the waste stream is allocated to large geographical areas - a total of five areas. Consequently, these values could not easily be tied into point source waste generator sites and were therefore ignored.

No attempt has been made to convert tonne-kilometres hauled to transport vehicle trips. The major missing element to such a calculation is the average vehicle loading which would vary if consolidation stations are used to aggregate waste for the purpose of increasing shipment size. Without this feature, the size of shipments received and thus the number of trucks would change.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROBABILITY OF TRANSPORT ACCIDENTS

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: The probability of transport accident was calculated based on the routings between source sites and receiver centroids and the average annual accident rate by road classification, to produce a value which can be compared between site areas to produce an index of relative accident frequency.

RATIONALE/SIGNIFICANCE: The calculation of an accident frequency rate for each of the site areas requires a determination of the total number of vehicles using each link within the provincial road network. As this was not possible for reasons noted in the factor write-up of Transport Costs (see Comments/Assumptions/Limitations), a surrogate procedure was developed as an indicator.

SOURCES OF INFORMATION:

- tonne-kilometres of haulage for each receiver centroid by road classification (see Transport Cost Factor);
- the average for five years (1978-1982) of the recorded accident rates on all provincial roadways for four road type groupings. This information was extracted from the 1983 publication of the Ministry of Transportation and Communications, Traffic Volumes, King's Highway and Secondary Highways.

INTERPRETATION/METHODOLOGY: The basic input used was the tonne kilometres hauled from all special waste origin sites to each of the receiver centroids as described in the factor: Transport Cost. During these calculations, the tonne-kilometres of haulage on each of the four road link types was aggregated separately.

The total values calculated by each road link type was then multiplied by the five-year average accident rate. The values used were:

- Freeways	0.76 accidents/1 million kilometres travelled
- King's Highways	1.20 accidents/1 million kilometres travelled
- Secondary Highways	1.61 accidents/1 million kilometres travelled
- Other Roads	4.29 accidents/1 million kilometres travelled

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF SITE AREAS (CONSTRAINT MAPPING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROBABILITY OF TRANSPORT ACCIDENTS

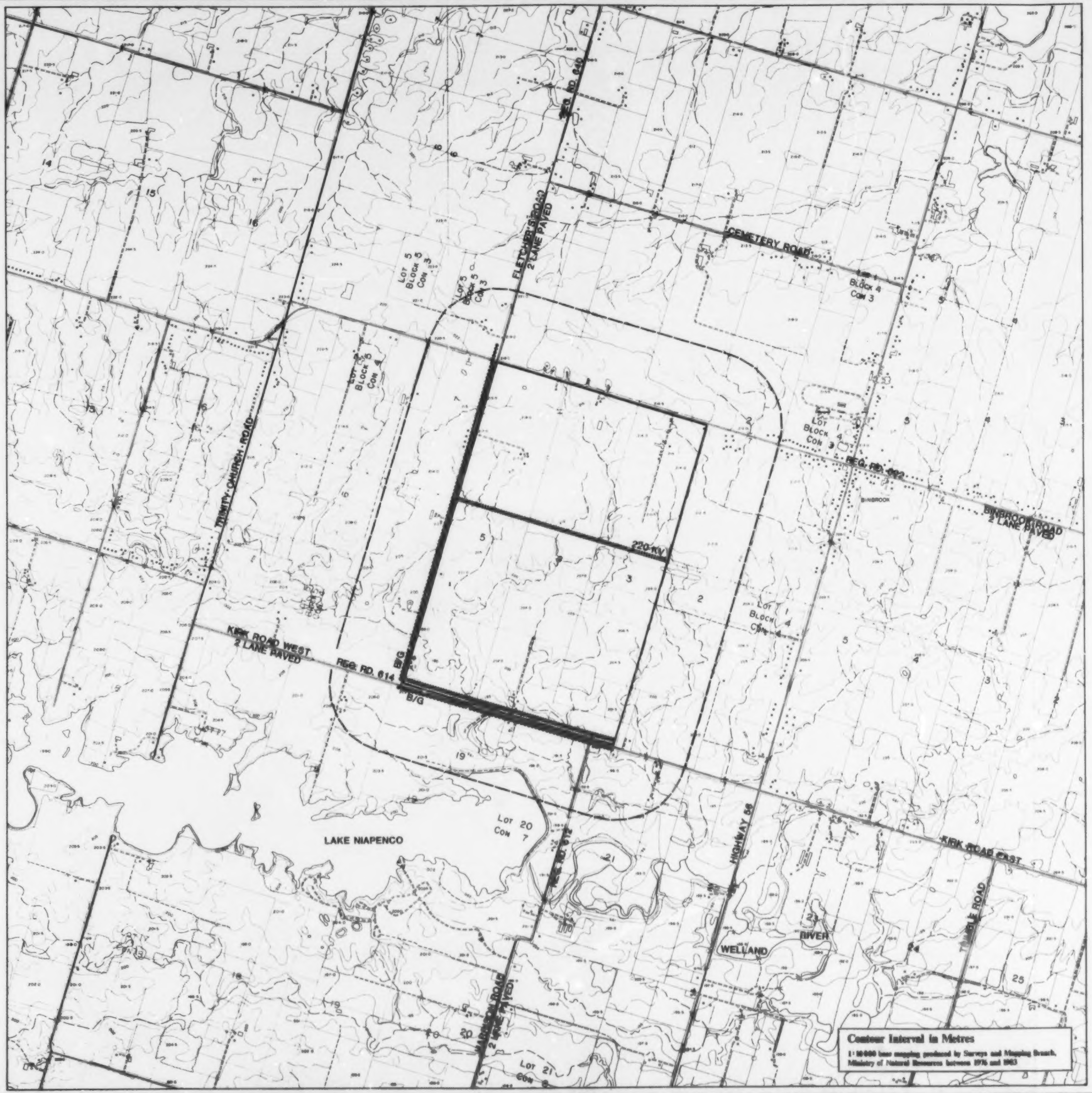
The summation of these calculations for each receiver centroid or combination, produces a number which is a surrogate for transport accident risk in relation to each receiver centroid.

The accident probability index was combined with the transport cost index to derive a composite index for use in Constraint Mapping.

CRITERIA/INDICATORS: The calculated values of each cluster centroid represent the accident frequency for various candidate regions composed of candidate areas.

COMMENTS/ASSUMPTIONS/LIMITATIONS: A limitation is that average accident rates were used for four route type groupings. Consequently, the index produced does not reflect the actual variations that exist between various route links within the provincial system. This is a refinement that can be dealt with as other required information essential to detailed forecasting becomes available.

APPENDIX B
WORKED EXAMPLE OF SITE AREA SCREENING (SITE LF-4W) USING FIELD AND OFFICE DATA SHEETS


CEMETERY ROAD
FLETCHER ROAD
2 LANE PAVED
REG. RD. 640
TRINITY CHURCH ROAD
LOT 5
BLOCK 5
CON 3
LOT 5
BLOCK 5
CON 4
LOT 1
BLOCK 4
CON 3
LOT
BLOCK 4
CON 3
LOT 1
BLOCK 4
CON 4
REG. RD. 602
BINBROOK
BINBROOK ROAD
2 LANE PAVED
220 KV
B/G
KIRK ROAD WEST
2 LANE PAVED
REG. RD. 614
LAKE NIAPENCO
LOT 20
CON 7
REG. RD. 612
HIGHWAY 56
KIRK ROAD EAST
TRIMBLE ROAD
WELLAND
RIVER
HARRISON ROAD
2 LANE PAVED
LOT 21
CON 8
14
15
16
19
20
21
25

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

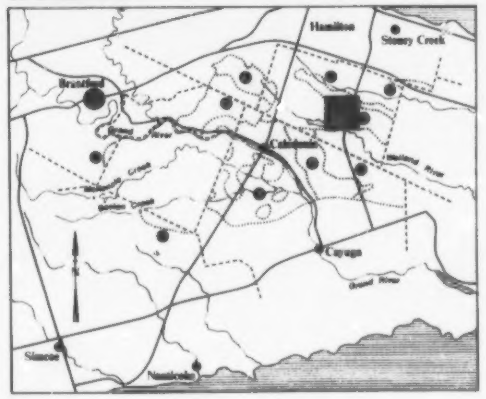
- Hydro Line
- Pipeline
- Telephone Line
  - A/G - Above Ground
  - B/G - Below Ground

not to scale

MAXIMUM POTENTIAL ACQUISITION BOUNDARY — 400m STUDY AREA

Key Map: **LF-4 West**

Lots 3,4,5; Concession IV (Block 4); Township of Glanbrook, formerly Township of Binbrook


Hamilton
Stoney Creek
Brantford
Caledonia
Cayuga
Simcoe
Nanticoke

1000 feet 0 1000
500 metres 0 500

Transportation Factors
POTENTIAL SITE IDENTIFICATION

October 1984

MAP DT-17

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: TRANSMISSION LINE FIELD DATA - ELECTRIC TRANSMISSION (ONTARIO HYDRO)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No.
3. Date of Field Investigation 6 December 1983
4. Investigation Team TJO, BIK, JRC
5. Location of Transmission Lines in relation to site-identify on 1:10,000 mapping bisect site from west to east
6. Number of rows of towers and/or poles 1
7. Number of lines per tower and/or poles 3 + 2 static
7A. Number of lines per insulator 1
7B. Number of disks per insulator 18
8. Transmission Voltage 220,000 volts
9. Width of corridor (easement) Not determined
10. Photo Index #7 & #8, 6 Dec. 1983 to east from Fletcher Rd.S. (date, direction and location identify on 1:10,000 mapping) Yes
11. Indication of Proposed Line Improvements None (additional towers of lines, increased in easement width, etc.
12. Were you questioned by locals and/or government representatives (time, location names) No
13. Secondary Sources Used
14. Date of Cross-checking with office data
15. Comments

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: TRANSMISSION LINE FIELD DATA - PIPELINES (GAS/OIL)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. N/A
3. Date of Field Investigation 6 December 1983
4. Investigation Team BIK, TO, JRC
5. Location of Pipeline in Relation to Site (Identify on 1:10,000 Mapping) No pipelines on-site
6. Owner and/or Operator
7. Number of Pipelines in Corridor
8. Size of Pipelines
9. Width of Corridor (easement)
10. Photo Index (date, location and direction identify on 1:10,000 Mapping
11. Indication of Proposed Improvements
12. Were you Questioned by Locals and/or government representatives time, location and names
13. Date of Cross Check with Office Data
14. Secondary Sources
15. Comments

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION

PART 1: TRANSMISSION LINE FIELD DATA - WATER TRANSMISSION (STORM, SANITARY, WATER MAINS)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. N/A
3. Date of Field Investigation 6 December 1983
4. Investigation Team BIK, TO, JRC
5. Location of Conduit in Relation to Site (Identify on 1:10,000 Mapping) No conduit on-site
6. Owner
7. Number of Conduits
8. Size of Conduits
9. Width of Corridor (Easement)
10. Photo Index (date, location and direction, identify on 1:10,000 mapping)
11. Indication of Proposed Improvements
12. Were you Questioned by Local and/or government representatives (time, location and names)
13. Date of Cross Check with Office Data
14. Secondary Sources
15. Comments

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: TRANSMISSION LINE FIELD DATA - DATA TRANSMISSION (TELEPHONE/TELEGRAPH)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. N/A
3. Date of Field Investigation 6 December 1983
4. Investigation Team BIK, TO, JRC
5. Location of Cable in Relation to Site No cable on-site
(Identify on 1:10,000 mapping)
6. Owner
7. Number of Cables
8. Size of Cables
9. Width of Corridor (Easement)
10. Photo Index
(date, location and direction, identify
on 1:10,000 mapping)
11. Above or Below Ground (depth)
12. Indication of Proposed Improvements
13. Were you Questioned by Local
and/or government representatives
(time, location and names)
14. Date of Cross Check with Office Data
15. Secondary Sources
16. Comments

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: AIRPORT FIELD DATA

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. N/A
3. Date of Field Investigation 6 December 1983
4. Investigation Team BIK, TO, JRC
5. Features Investigated: Airport Location to candidate site in relation to obstacle control and take-off and landing paths.
6. Secondary Sources Used 1:10,000 + 1:50,000 OWMC maps
7. Date of Cross-Checking 13 December 1983
8. Name of Airport No airports in vicinity
9. Municipality
10. Airport Location
(with respect to site
11. Runway Directions
12. Distance from Runway
to site
13. Observed Level of
Airport Activity
14. Photo Index
(date, location, direction)

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: RAILWAY FIELD DATA

1. Site Area No. LF-4W

2. Aerial Photograph No.

3. Date of Field Investigation 6 December 1983

4. Investigation Team JRC, TO, BIK

5. Features Investigated: Abandoned or Existing Railway Lines in proximity to candidate site None

6. Secondary Sources Used 1:10,000 and 1:50,000 OWMC Maps

7. Date of Cross-Checking 13 December 1983

8. Rail Line Ownership N/A

9. Rail Line Characteristics N/A
(No. of tracks, location to site, other features)

10. Does a spur connection appear viable? N/A
. Existing conflicts?

14. Photo Index N/A
(date, location, direction)

SAMPLE ONLY

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 1: ROADWAYS FIELD DATA

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No.
3. Date of Field Investigation 6 December 1983
4. Investigation Team JRC, TO, BIK
5. Features Investigated Possibilities for road closure or route relocation if closure not feasible. None required
6. Secondary Sources Used 1:10,000 and 1:50,000 OWMC Maps
7. Date of Cross-Checking 13 December 1983
8. Site Location Municipality Glanbrook - Region of Hamilton-Wentworth

   Road Name and No. RR 50 on west; RR 622 on north; RR 614 on south

   Road Surfaces Type Paved; Paved; Paved;
9. Field Photo Index
   (date, location, direction)
10. Description of Road Features
    (alternative routings possible;
    (road surface of alternatives, etc.

o Bimbrook Road;
- Flanks north side of site;
- 2 lanes paved;
80 km/hr.

o Glanbrook Conc. 7/Kirk Rd. West;
- Flanks South Side of Site;
- 2 lane paved;
- Poor surface condition.

o Fletcher Road South/Regional Road 50;
- Flanks west side of site;
- 2 lane paved.

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: TRANSMISSION LINE OFFICE INFORMATION
- ELECTRIC TRANSMISSION
(ONTARIO HYDRO)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. 78 430 9 60 65, 66, 67
3. Date of Office Review 9 December 1983
4. Reviewer CBD
5. Sources Used Aerial/TOPO maps
6. Location identify on 1:10,000 mapping) Centre of site
7. Number of rows of towers and/or poles 1
8. Number of lines per tower and/or pole 3 + 2 static
9. Transmission Voltage 220K volts
10. Width of Corridor (identify on 1:10,000 mapping
11. Proposed Improvements
12. Date of Cross-Checking with Field Data 9 December 1983
13. Comments 230 kv line - Ontario Hydro Data 1974

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: TRANSMISSION LINE OFFICE INFORMATION - PIPELINES (GAS/OIL)

1. Site Area No. LF-4W
2. Aerial Photograph No. 78 430 9 60 65, 66, 67
3. Date of Office Review 9 December 1983
4. Reviewer CBD
5. Sourced Used Aerial/TOPO/
6. Location identify (on 1:10,000 mapping) No pipelines on-site
7. Onwer and/or Operator
8. Number of Pipelines in Corridor
9. Size of Pipelines
10. Width of Corridor (easement)
11. Proposed Improvements
12. Date of Cross-Checks with Field Data
13. Comments

SAMPLE ONLY

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: TRANSMISSION LINE OFFICE INFORMATION
- WATER TRANSMISSION
(STORM, SANITARY, WATER MAINS)

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. 78 430 9 60 65, 66, 67
3. Date of Office Review 9 December 1983
4. Reviewer CBD
5. Sources Used Aerial/TOPO
6. Location of Conduit in Relation to Site (Identify on 1:10,000 Mapping) No conduit on-site
7. Owner ______
8. Number of Conduits ______
9. Size of Conduits ______
10. Width of Corridor (Easement) ______
11. Proposed Improvements ______
12. Date of Cross-Check With Field Data ______
13. Comments ______

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: TRANSMISSION LINE OFFICE INFORMATION - DATA TRANSMISSION (TELEPHONE/TELEGRAPH)

1. Site Area No. LF-4W
2. Aerial Photograph No. 78 430 9 60 65, 66, 67
3. Date of Office Review 9 December 1983
4. Reviewer CBD
5. Sources Used Aerial/TOPO
6. Location of Cable in Relation to Site No cable on-site
   (Identify on 1:10,000 mapping
7. Number of Cables
8. Size of Cables
9. Width of Corridor (Easement)
10. Above or Below Ground (Depth)
11. Proposed Improvements
12. Date of Cross-Check With Field Data
13. Comments

SAMPLE ONLY

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: AIRPORT OFFICE INFORMATION

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No.
3. Date of Office Reivew 13 December 1983
4. Reviewer TO, JRC
5. Features Investigated: Airport location to candidate site in relation to obstacle control or take-off and landing paths.
   None
6. Secondary Sources Used 1:10,000 and 1:50,000 OWMC maps
7. Date of Cross-Checking 13 December 1983
8. Does Obstacle Control Apply? No
9. Is Site Within Take-off or Landing Paths No
10. If Yes, Identify Effects on Site (clearances required, etc.)
    N/A
11. Conclusions No airports located near site.

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: RAILWAY OFFICE INFORMATION

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No.
3. Date of Office Reivew 13 December 1983
4. Reviewer TO, JRC
5. Features Investigated: Abandoned or Existing Railway Lines in proximity to candidate site. None
6. Secondary Sources Used 1:10,000 and 1:50,000 OWMC Maps
7. Date of Cross-Checking 13 December 1983
8. Elevation of Rail Trackage at Site N/A
9. Elevation of Site Adjacent to Trackage N/A
10. Rail Line Conflicts (junctions, yards, etc.) N/A
11. Is additional land acquisition required to access site? N/A
12. Conclusions No rail located near site.

OWMC
PHASE 3 SCREENING OF AREAS AND SITE DELINEATION
PART 2: ROADWAY OFFICE INFORMATION

SAMPLE ONLY

1. Site Area No. LF-4W
2. Aerial Photograph No. ________
3. Date of Office Reievew 13 December 1983
4. Reviewer TO, JRC
5. Features Investigated: Possibility of road closure or route relocation if closure not feasible. None required.
6. Secondary Sources Used 1:10,000 and 1:50,000 OWMC Maps
7. Date of Cross-Checking 13 December 1983
8. Road Closure Required None
9. Parallel or Connecting Roadways N/A
10. AADT and Date N/A
    - . on road proposed for closure ________
    - . on connecting and parallel roads ________
11. Trip detours involved by direction from: ________
    - . north N/A
    - . south ________
    - . east ________
    - . west ________

OWMC

PHASE 3 SCREENING OF AREAS AND SITE DELINEATION

PART 2: ROADWAY OFFICE INFORMATION

(continued)

12. Conclusions: Site is served directly from any of three Hamilton-Wentworth Regional Road (50, 622 and 614). Access to QEW would be north along Highway 56 and thence Highway 20 through Hamilton.

SAMPLE ONLY

APPENDIX C

FACTOR SHEETS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** UTILITY TRANSMISSION INSTALLATIONS AND EXISTING UTILITIES ALONG ROAD ALLOWANCES

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR:

- Same as Constraint Mapping Factor.
  This factor was applied at the suitability screen level.

RATIONALE/SIGNIFICANCE:

- Same as Constraint Mapping for installation outside road allowance. Also, utility relocation will be necessary in the event of a road closure.

SOURCES OF INFORMATION:

- Information collected during Constraint Mapping activity
- Field reconnaissance of sites and information recorded on field and office information data sheets
- OWMC 1:10 000 and 1:50 000 scale base maps.

INTERPRETATION/METHODOLOGY: Field information was used to prepare 1:10 000 scale maps which identified the location of utilities along roads adjoining sites and roads into sites. In addition, installations outside of road allowances were also identified.

CRITERIA/INDICATORS:

- Same as Constraint Mapping applied on a site level.

COMMENTS/ASSUMPTIONS/LIMITATIONS: Due to the sensitive nature of the work it was not possible to contact specific utility agencies to investigate future utility and transmission line installations.

DECEMBER 1983

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** AIRPORTS

FACILITY COMPONENTS AFFECTED: All, but to varying degrees - incinerator sites are affected the most followed by physical/chemical treatment and landfill due to the variability of assumed height obstruction.

DEFINITION OF FACTOR:

- Same as Constraint Mapping.
  This factor was applied at the suitability screen level.

RATIONALE/SIGNIFICANCE:

- Same as Constraint Mapping applied at a site area level.

SOURCES OF INFORMATION:

- Same as Constraint Mapping.
- Field reconnaissance leading to the completion of the field and office information data sheets.
- OWMC 1:10 000 and 1:50 000 scale base maps.

INTERPRETATION/METHODOLOGY: Field investigations were used to note the orientation of airport runways in relation to specific site areas.

CRITERIA/INDICATORS: The airport runways orientation was used as input to the calculations of transitional surfaces as shown in Contraint Mapping.

COMMENTS/ASSUMPTIONS/LIMITATIONS: All control surfaces are subject to interpretation by Transport Canada staff. Any site areas located near airports must be referred to them for interpretation of the degree of conflict and effects on airport licence and operation.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** RAILWAY LINES

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR:

- Same as Constraint Mapping.
  This factor was applied at the suitability screen level.

RATIONALE/SIGNIFICANCE:

- Same as Constraint Mapping applied at a site area level.

SOURCES OF INFORMATION:

- Information gathered from the field and recorded on Field Data Sheets and Office Information Sheets
- Secondary sources using OWMC 1:50 000 and 1:10 000 scale plans
- Information gathered during Constraint Mapping

INTERPRETATION/METHODOLOGY:

- Same as Constraint Mapping applied on a site area level.
- Investigate rail access possibilities on a site area level.

CRITERIA/INDICATORS:

- Same as Constraint Mapping applied on a site area level.

COMMENTS/ASSUMPTIONS/LIMITATIONS:

- Same as Constraint Mapping.

DECEMBER 1983

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** ARTERIAL ROADS

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR:

- Same as Constraint Mapping Factor
  This factor was applied at the suitability screen level.

RATIONALE/SIGNIFICANCE:

- Information gathered during the constraint mapping stage
- Information gathered from field reconnaissance, recorded on field data and office information sheets
- OWMC 1:10 000 and 1:50 000 scale base mapping

INTERPRETATION/METHODOLOGY:

- Same as Constraint Mapping applied at a site area level.

CRITERIA/INDICATORS:

- Same as Constraint Mapping applied on a site area level.

COMMENTS/ASSUMPTIONS:

- Same as Constraint Mapping.

DECEMBER 1983

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** TRANSPORT COST

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR:

- Same as Constraint Mapping Factor.
  This factor was applied on a regional basis at the system screening level.

RATIONALE/SIGNIFICANCE:

- Same as Constraint Mapping.

SOURCES OF INFORMATION:

- Same as Constraint Mapping.

INTERPRETATION/METHODOLOGY:

- Same as Constraint Mapping, except transport costs considered separately from accident probability.

CRITERIA/INDICATORS: The indicator used was the total annual tonne-kilometres hauled to each cluster centroid. This acts as an indicator of the cost of haulage to site areas near these centroids.

COMMENTS/ASSUMPTIONS:

- Same as Constraint Mapping.

DECEMBER 1983

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** TRANSPORT ACCIDENT PROBABILTY

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR:

- Same as Constraint Mapping Factor.
  This factor applied on a regional basis at the system screening level.

RATIONALE/SIGNIFICANCE:

- Same as Constraint Mapping.

SOURCES OF INFORMATION:

- Same as Constraint Mapping.

INTERPRETATION/METHODOLOGY:

- Same as Constraint Mapping, except transport accident and transport costs considered separately.

CRITERIA/INDICATORS: The indicator used was the index of the probability of an accident for each cluster centroid. This acts as an indicator of the accident probability at the site near these centroids.

COMMENTS/ASSUMPTIONS:

- Same as Constraint Mapping.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF POTENTIAL SITES (SITE AREA SCREENING)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	HAUL DISTANCE BETWEEN PI and LF SITES

FACILITY COMPONENTS AFFECTED: All partially integrated facilities.

DEFINITION OF FACTOR: The length of the road route which will be travelled by the vehicles hauling partially solidified wastes from the physical chemical/ incineration plant to the landfill site. This factor was applied at the system screen level, and as an input to transport costs and accident probability factors.

RATIONALE/SIGNIFICANCE: The additional haulage of partially solidified wastes to the landfill for a partially integrated site option results in additional noise, disturbance and risk, than the fully integrated site option. To minimize these impacts it was necessary to determine the distance between various PI and LF sites and give preference to the combination with the least haul distance.

SOURCES OF INFORMATION: Related information was collected in conjunction with the factor "Transportation Costs" and "Arterial Roads", as described under Constraint Mapping.

INTERPRETATION/METHODOLOGY: By investigating the possible routings between PI and alternate LF sites, it was possible to determine which combination of PI and LF sites would involve the least haulage distance.

CRITERIA/INDICATORS: The roadway distance between the PI and associated landfill site was the only indication used.

COMMENTS/ASSUMPTIONS/LIMITATIONS: No analysis of road safety characteristics has been completed at this time. This will be undertaken for all transportation routes identified during the detailed comparative evaluation of sites.

DECEMBER 1983

APPENDIX D
TRANSPORTATION MODEL DEVELOPMENT

APPENDIX D
TRANSPORTATION MODEL DEVELOPMENT

CHAPTER D.1
ORGANIZATION

The following three sections to this Appendix to the report present the technical documentation of a three-phase model development process applied for purposes of selecting OWMC potential facility sites for treatment and disposal of hazardous liquid industrial waste and solid wastes. These phases included:

PREFERRED ROUTE SELECTION

This phase included the development of an Ontario-wide road network designed to accommodate the transport of all wastes from identified municipal source sites, to four candidate treatment receiver areas. During this phase, the resulting minimum time and distance path routings were reviewed and compared, and routing adjustments were made to maximize the use of the 400-series highways and to minimize intrusion within urbanized areas along non-freeway type routes.

PREFERRED ROUTE REFINEMENT

This phase involved the addition of three additional candidate treatment receiver areas within the Niagara Peninsula. More detailed inspection of local access routes was then undertaken within the receiver areas to confirm the suitability of the computer developed access route network.

ADDITION OF RECEIVER CENTROIDS

This phase involved the addition of ten new facility receiver areas to permit a refinement of comparative evaluation data due to the large number and wide scatter of potential treatment facility sites which had emerged during the site screening activity. This was necessary to include an additional candidate area in Brampton, while the remainder were enhancements within the Niagara Peninsula candidate area.

CHAPTER D.2
INTRODUCTION TO PREFERRED ROUTE SELECTION

1. OBJECTIVES

This documents the methodology and results of the Preferred Route Selection phase of the transportation study to determine alternative truck routes for the purpose of transporting hazardous liquid industrial waste and hazardous waste in the Province of Ontario. The results of this investigation will be utilized by the Ontario Waste Management Corporation (OWMC) in future decisions regarding the selection of a site for the planned receiver facility to safely treat and dispose of liquid industrial waste and hazardous waste (herein referred to as "waste").

The main objectives of this phase of the study are:

- to develop an Ontario-wide network of highways as a tool for the determination of alternative truck routes;
- to identify alternative truck routes from the various waste-generating areas throughout Ontario to hypothetical receiver sites within the candidate areas in Southern Ontario;
- to determine the local sensitivity of alternative routes to a specific receiver site within a candidate area;
- to identify the preferred truck routes from each waste-generating area to hypothetical receiver sites.

2. AN OVERVIEW

This investigation can be broken down into the following steps:

- the development of the Ontario highway network to include road improvements or additions expected to occur by the year 1988;
- determination of feasible alternative truck routes to minimum time or distance routes;
- selection of the preferred truck routes based on selected criteria.

It is emphasized that the various alternatives presented herein are based on preliminary information regarding network source points and candidate receiver sites.

It is intended that the alternative routes determined in this study be investigated in light of an expanded criteria and more specific information at later stages of the site selection process.

CHAPTER D.3
THE OWMC HIGHWAY NETWORK

1. INTRODUCTION

The objective in building a highway network for the OWMC was to produce an analytical tool to be used for the determination and selection of preferred trucking routes from points throughout the Province of Ontario to candidate receiver sites within the proposed candidate areas.

A highway network is actually a series of interconnecting links which represent transportation corridor patterns within an area. Each link represents all or part of a corridor having common characteristics (i.e. speed, classification, etc.). This network of links facilitates and determines the path of the movement between zones.

The preliminary information required prior to building a network is:

- study area boundary;
- level of detail required in the zone breakdown and highway data;
- breakdown of study area into zones (i.e. source and receiver sites);

- appropriate source point of each zone in the network;
- highway link information (i.e. distances, speeds, and travel times).

These point are discussed in this chapter.

2. DEVELOPMENT OF THE OWMC HIGHWAY NETWORK

THE STUDY AREA

The study area has been previously specified to include all producers of hazardous liquid industrial waste and hazardous waste in the Province of Ontario.

Therefore, we have assumed the study area boundary to be the provincial boundary. Waste producers outside the Province have not been considered.

WASTE GENERATING ZONES

The Province has been divided into 43 waste-generating municipal areas or zones. This breakdown was derived and revised from OWMC Waste Quantities Study (The Proctor and Redfern Group 1982, Appendix G) where the constituent municipalities were determined for each area.

Appropriate network source points representative of each municipal area were chosen on the following basis:

1. Centrally located and easily accessible from all points within the zone.

2. High population and/or industrial density within zone.

Table D-1 shows the summary of network source points.

CANDIDATE RECEIVER SITES

In previous studies, four cluster areas in Southern Ontario were chosen for further investigation as candidate waste receiver areas.

Generally, these areas were located in the Town of Milton, Cities of Brampton and Mississauga, and throughout the Niagara Peninsula between Brantford and the City of Niagara Falls.

Four hypothetical receiver sites, as listed below, were chosen for the testing and selection of preferred truck routes carrying waste to the candidate areas.

CANDIDATE RECEIVER SITE	SITE LOCATION
i) Brampton-Mississauga	- junction of Highway 401 and Highway 10
ii) Town of Milton	- Highway 25 near Omagh community
iii) Hagersville	- Highway 6, north of Hagersville community
iv) Smithville	- Highway 20, near Smithville (south of Grimsby)

TABLE D.1
NETWORK SOURCE SITES

MUNICIPAL AREA	NETWORK SOURCE SITES
Windsor	Highway 2 at junction of Highway 3
Chatham	Highway 2 at Highwy 40
Sarnia	Highway 40 at junction of Highway 402
St. Thomas	Highway 3 near St. Thomas
London	Highway 2 at Highway 100 in London
Woodstock	Highway 2 at junction of Highway 59
Stratford	Highways 7/8 at junction of Highway 19
Walkerton	Highway 9 at junction of Highway 4
Owen Sound	Highways 6/10 at junction of Highway 26
Guelph	Highway 7 at junction of Highway 6
Kitchener	Highway 7 at junction of Highway 86
Brantford	West junction of Highways 24 and 403
Simcoe	Highway 3 at junction of Highway 24
Dunnville	Highway 3 and Dunnville
Welland	Highway 58 in Welland
St. Catharines	QEW at junction of Highway 406
Grimsby	QEW at Grimsby
Hamilton	Highway 403 at Highway 8 in Hamilton
Oakville	QEW at Highway 403
Milton	Highway 401 at Highway 25
Mississauga	QEW at Highway 10
Brampton	Highway 10 at north junction of Highway 7
Orangeville	Junction of Highways 9 and 10
Barrie	Highway 400 at junction of Highway 26
Aurora	Highway 400 at King City
Toronto	Junction of Highways 401 and 11
Oshawa	Highway 401 at City of Oshawa

TABLE D1
NETWORK SOURCE SITES
(continued)

MUNICIPAL AREA	NETWORK SOURCE SITES
Lindsay	Highway 35 at Highway 7 near Lindsay
Cobourg	Highway 401 at junction of Highway 45
Peterborough	Junction of Highways 7 and 28
Huntsville	Highway 11 at junction of Highway 60
Belleville	Highway 401 at junction of Highways 37 and 62
Kingston	Highway 401 near junctions of Highways 15 and 38
Brockville	Junction of Highways 401 and 29
Ottawa	Junction of Highways 417, 16, and 31
Cornwall	Junction of Highways 401 and 138
Hawkesbury	East junction of Highways 17 and 417
North Bay	Highway 11 at junction of Highway 17 near North Bay
Sudbury	Highway 17 at junction of Highway 69
Sault Ste. Marie	Highway 17 at junction of Highway 757
Kirkland Lake	Highway 60 near Kirkland Lake
Cochrane	Highway 11 at Cochrane
Thunder Bay	Highways 11/17 near Thunder Bay

These hypothetical sites were chosen to assist in determining how sensitive both the remote routes and very local routes are to the location of the receiver site.

For example, the candidate areas in the Niagara Peninsula cover a large geographical area. Several feasible routes into the area exist. In this case, two candidate areas were chosen; one in the northern sector, and one in the south. It was necessary to determine what effect these site locations have on the routes to that area.

THE HIGHWAY LINK DATA

The purpose is to examine truck routing between network loading points representing the 43 waste-generating municipalities in Ontario and those zones created to represent the four hypothetical receiver sites.

Therefore, highway link data was collected to simulate an up-to-date Provincial highway system that would connect these zones. Highway improvements and extensions projected up to the year 1988 were included.

The level of network detail required for preliminary route selection includes all King's highways, Regional arterial roads and some key secondary highways. This network will be referred to herein as the coarse highway network.

Later in the analysis though, a network with a much higher level of detail in and around the candidate receiver sites will be used.

The OWMC coarse highway network was developed through the modification of two existing highway networks developed and extensively tested by the Ontario Ministry of Transportation and Communications (MTC). These networks are:

i) Ontario Wide Travel Simulation Road Network (OWTS) 1976
   - includes network layout and link data for all King's and Provincial highways, with some secondary highway detail

ii) Central Ontario Region Off-Peak Road Network No.8 (COR) 1976
   - provides high level of detail throughout the Niagara, Lake Erie and Metropolitan Toronto areas

The backbone of the OWMC highway network was derived from a modified OWTS Road Network. The same basic network layout and link numbering system was assumed. It also provided the essential link attributes required for route selection (i.e. operating speed, link length and travel time).

All links representing corridors to out-of-Province destinations were eliminated from the OWMC network.

Additional highway detail was added in the Niagara-Lake Erie area where the level of detail of the OWTS Road Network was inadequate. Link attributes were obtained for these additional links from the 1976 COR Network.

Network building also included the updating of the entire 1976 network to incorporate both present day conditions, and forecasted 1988 conditions. The forecasted network improvements incorporated are in Table D-2. Any improvement beyond the year 1988 was not recognized in the network. Those improvements investigated but forecasted beyond 1988 are:

TABLE D-2

IMPROVEMENTS TO HIGHWAY NETWORK (1976-1988)

HIGHWAY	LOCATION	NEW OR REVISED SPEED	STATUS OF PROJECT
CALEDONIA BY-PASS	- Highway 6 at Caledonia	*	- to be completed in 1983
E.C. ROW EXPRESSWAY	- from Highway 2 to Highway 18 in Windsor	80	- new expressway now completed
INGERSOLL EXPRESSWAY	- Highway 2 at Ingersoll	*	- has been completed
KITCHENER/ WATERLOO EXPRESSWAY	- Kitchener/Waterloo to Freeport	96	- recently constructed to freeway standards
MOUNTAIN EXPRESSWAY	- from QEW in Hamilton to Highway 403 in Ancaster	64 (at grade) 80 (grade separation)	- a new corridor through Hamilton to be constructed by 1988
8	- Highway 401 to Freeport	96	- upgrading to freeway to be complete by 1988
11	- from Highway 11 in Barrie to the Highway 60 junction near Huntsville	96	- upgrading to an expressway to be complete by 1988
11	- from Powassan to Callandar	96	- upgrading to expressway to be completed by 1988
35/115	- from Highway 401 north to junction of Highways 35 and 115	90	- upgrading to expressway to be completed by 1988
115	- from Highway 35 junction to Peterborough By-pass at Highway 7	90	- upgrading to expressway to be completed by 1988
400	- extension north via new Coldwater By-pass to Highway 69	96	- extension opened in 1978-79

TABLE D-2
IMPROVEMENTS TO HIGHWAY NETWORK (1976-1988)
(continued)

HIGHWAY	LOCATION	NEW OR REVISED SPEED	STATUS OF PROJECT
400	- extension north to Honey Harbour Road (Muskoka Road No. 5)	96	- extension of Highway 400 to be completed by 1988
402	- from Bluewater Bridge, Sarnia to Highway 401 near London	96	- new expressway now fully opened
403	- from Highway 401, Mississauga to the QEW, Oakville	96	- new portion expressway recently opened
403	- from Highway 24, Brantford to Highway 401 Interchange 236 (Towerline Road)	96	- extension to be completed by 1988
404	- from York Regional Road 40 north to Regional Road 31 (Davis Drive in Newmarket)	96	- extension to be completed by 1988
406	- in St. Catharines from the QEW to Westchester Street	96	- extension to be completed by 1988
406	- from Merritt Road, Thorold to East Main Street bridge in Welland	80	- extension to be completed by 1988
410	- from Highway 401 to Steeles Avenue	80	- presently exists as staged freeway - to be upgraded beyond our time frame
410	- from Steeles Avenue to north of Highway 7	96	- upgrading to expressway to be completed by 1988
427	- from Rexdale Boulevard to Highway 7	*	- extension to be completd as expressway by 1988

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* These improvements have not been included in the 1988 Highway Network as their effect on the time and distance routes will be negligible.

Highway 3 - realignment from Port Colborne to Jarvis to be controlled access

- 10-20 year time frame

Highway 6 - widening from Highway 401 to Highway 403 (Hamilton) from two to four lanes will occur within 20-year time frame

- improvements from Hamilton to Nanticoke

- beyond the 20-year time frame

Highway 11 - widening from Highway 60 (Huntsville) to Powassan from two to four lanes

- will occur within 20-year time frame

Highway 16 - upgrade to expressway from Highway 401 north to Ottawa

- will occur within 20-year time frame

Highway 24 - Hespeler By-pass

- staged freeway project from Highway 401 to halfway to Guelph

- will occur within 20-year time frame

Highway 89 - extension from Highway 11 to Highways 7 and 12 near Sunderland

- to be completed by 1990

Highway 115 - upgrade to four-lane expressway from Highway 35 junction to Highway 7 in Peterborough

- to occur within 10-year time frame

Highway 403 - Oakville to Hamilton link

- Duff's Corners to Cainsville link

- both are post 1990 projects

- construction of expressway from Oakville/403 north to Georgetown via Ninth Line to be complete within 10-year time frame

Highway 406 - widening from two-lane section to four-lane divided highway from Beaversdam Road to Merritt Road within 10 years

Highway 407 - construction from Highway 410 to Dufferin Street/Bathurst Street to occur within 15 years

- extensions west to Highway 401 and east to Highway 404 are projected to be complete in 20 years

Hamilton Perimeter Industrial Road - from QEW to Highway 403
- construction projected for early 1990s

The OWTS Road Network included many zones or network loading centroids throughout the Province. These points have been relocated where necessary to better reflect source sites in situating the 43 municipal areas or zones within the network.

HIGHWAY LINK DATA SOURCE

The highway network improvements noted were obtained through the Ontario Ministry of Transportation and Communications, Capital Programs Section during July 1983. It is to be emphasized that the completion dates are "best estimates" as priorities may change from year-to-year and are also influenced by the capital funding available based upon approved fiscal budgets.

The link attribute data, (i.e. road link length and speed) input to the analysis, were those established by the Ontario Ministry of Transportation and Communications, Policy Planning Branch, Demand Analysis Office. In most instances these data were extracted from either the OWTS or COR network. Where it was necessary to input updated links, the Demand Analysis Office was contacted to secure an opinion as to the appropriate travel speed to be used. By these means, a basic consistency was maintained among routes of various road classifications.

CHAPTER D.4
THE INVESTIGATION OF FEASIBLE TRUCK ROUTES

1. INTRODUCTION

A highway network can be described as a series of interconnecting links which can be used to facilitate movement from one point to another.

This study examines those routes in Ontario connecting the waste-generating zones in Ontario to the four hypothetical candidate receiver sites in the Smithville, Hagersville, Milton, and Brampton-Mississauga areas.

The first step in this investigation was to determine routes involving the least time and least distance, i.e. the quickest and the shortest route. This task was completed using a series of microcomputer programs recently introduced in North America, the MOTORS Transportation Package (M.M. Dillon Limited, 1983)

The resultant minimum time and distance routes were established and then examined in light of other criteria.

Where minimum time and distance routes were deemed potentially unacceptable, alternative routes were investigated and compared on a time and distance basis. For example, non-freeway routings through large urban area concentrations were rejected when suitable alternative routings existed with only minor time or distance penalty.

2. THE MINIMUM PATHS

The routes representing the paths of minimum time and minimum distance between zones were computed through the use of the MOTORS Transportation Package.

MOTORS TRANSPORTATION PACKAGE

MOTORS is an integrated package of programs designed for microcomputer use. It provides a simple, low cost method of analyzing transport planning options.

In determining the minimum paths, the MOTORS programs categorized as the "Highway Network Models" were used. This series of programs is composed of separate and distinct units which can be used in succession to produce a final analysis. The programs utilized are summarized in Table D-3.

These programs enable the user not only to determine the minimum time and distance routes but also to summarize the calculated time and distance units for easy comparison.

The OWMC coarse highway network, as described in Chapter 14, was coded in the MOTORS format. A typical network coding form is shown in Figure D-1.

Each link in the network is identified by two node numbers; a "from" node and a "to" node. Link classification and at least two of the following: speed, link length, or travel time are required input.

TABLE D-3
*MOTORS TRANSPORTATION PACKAGE
Highway Network Programs

PROGRAM	TITLE	FUNCTION
P10	NETWORK CHECKING	- to edit link data of the highway network
P20	NETWORK BUILDING (PEAK HOUR)	- to prepare a new link file from the original data file, as required for the minimum path program
P40	MINIMUM PATHS	- to find the minimum paths through a network from a specified origin to a set of specified destinations - the set of paths from one origin to all specified destinations is called a "minimum path tree"
P50	SKIM MINIMUM PATHS	- to skim the minimum path trees produced by P40 on a criterion specified by the user (time, distance or a combination of the two)

* MOTORS Transportation Package (M.M. Dillon Limited, 1983)

MOTORS **NETWORK CODING FORM** Date Sheet of

5X	I5 NODE FROM	I5 NODE TO	F6.2 TRAVEL TIME (mins)	F6.2 LINK LENGTH (miles)	F4.0 LINK SPEED (mph)	F8 0 LINK CAPACITY (vph)	I3	I3 Capex code
1 2 3 4 5	6 7 8 9 10	1 2 3 4 5	6 7 8 9 20 1	2 3 4 5 6 7	8 9 30 1	2 3 4 5 6 7 8 9	40 1 2	3 4 5
							1 = centroid connector 2 = intersection delay 3 = link delay 4 = dummy link	Only needed if 24 hr volumes are to be analysed

Figure D.1 MOTORS Network Coding Form

Each zone is represented by a centroid and centroid connector. All routes must begin and end at a centroid.

MINIMUM TIME AND DISTANCE ROUTES

The minimum time and distance routes determined in the MOTORS analysis were mapped for purposes of analysis. The minimum time routes reflected the utilization of high-speed highways (i.e. 400-series) at the earliest possible point. Similarly, the minimum distance routes follow the shortest path regardless of the time involved. The amount of time and distance lost or gained in selecting one particular route over another is impossible to quantify because there are too many immeasurable quantities involved.

The routes were compared based on travel times and total route distances computed by MOTORS. Table D-4 summarizes all the routes examined: the minimum time and distance routes, plus the alternative routes discussed in the following section. Other criteria considered for route selection such as environmental hazard, accident risk, etc. will be approached in a later phase.

In many cases, the minimum time and distance routes follow the same path, for a given origin and destination. But in another extreme, the minimum time and distance routes can use different paths but still have similar travel times or distances. Where differences are negligible between time and distance paths, route selection based on these differences cannot be substantiated except by exhaustive testing of options.

TABLE D-4: COMPARISON OF ALTERNATIVE ROUTES TO CANDIDATE RECEIVER SITES

Zone Number	Source Zone	Route Description	CANDIDATE RECEIVER SITES							
			NIAGARA REGION Hagersville		NIAGARA REGION Smithville		TOWN OF MILTON		BRAMPTON-MISSISSAUGA	
			Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)
1	Windsor	i) Minimum Time	* 225	327	* 345	(353)	* 233	351	* 239	364
		ii) Minimum Distance	250	317	(248)	351	237	349	243	362
9	Chatham	i) Minimum Time	* 170	245	* 190	(271)	* 178	269	* 184	282
		ii) Minimum Distance	191	237	(203)	270	195	269	201	282
11	Sarnia	i) Minimum Time	* 164	236	* 184	(262)	* 172	260	* 178	273
		ii) Minimum Distance	178	232	(195)	258	186	256	192	269
15	St. Thomas	i) Minimum Time	104	123	* 133	(181)	* 121	179	* 127	192
		ii) Minimum Distance	104	123	(144)	176	126	179	132	192
		iii) Via Highway 401 - Highway 403 - Highway 54 - Highway 6	*(112)	(155)	N/A	N/A	N/A	N/A	N/A	N/A
18	London	i) Minimum Time	* 105	141	* 125	(166)	* 113	165	* 119	178
		ii) Minimum Distance	108	133	(145)	159	116	157	122	170
22	Woodstock	i) Minimum Time	* 69	88	* 89	(114)	* 77	112	* 83	125
		ii) Minimum Distance	69	88	(89)	114	77	112	83	125
24	Stratford	i) Minimum Time	* 103	130	119	148	* 89	116	* 95	129
		ii) Minimum Distance	103	130	119	148	89	116	95	129
		iii) Minimum Time with detour via Highway 6 from Guelph	N/A	N/A	(129)	(172)	(91)	(120)	(97)	(133)
		iv) Minimum Time with detour via Highway 401 at Cambridge and Highway 6 where applicable	N/A	N/A	*(120)	(162)	same as i), ii)		same as i), ii)	
		v) Via Highway 59 - Highway 401 - Highway 403 - Highway 20/53	N/A	N/A	(122)	(155)	N/A	N/A	N/A	N/A
31	Walkerton	i) Minimum Time	* 155	197	* 163	213	* 131	166	* 136	162
		ii) Minimum Distance	155	197	169	207	131	166	136	162
35	Owen Sound	i) Minimum Time	* 173	227	* 181	243	* 149	196	* 134	169
		ii) Minimum Distance	173	227	187	237	152	190	134	169
41	Guelph	i) Minimum Time	* 70	88	* 78	104	* 46	57	* 52	70
		ii) Minimum Distance	70	88	84	98	46	57	52	70

TABLE D-4: COMPARISON OF ALTERNATIVE ROUTES TO CANDIDATE RECEIVER SITES (continued)

			CANDIDATE RECEIVER SITES							
			NIAGARA REGION Hagersville		NIAGARA REGION Smithville		TOWN OF MILTON		BRAMPTON-MISSISSAUGA	
Zone Number	Source Zone	Route Description	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)
42	Kitchener-Waterloo	i) Minimum Time	83	99	92	109	* 62	77	* 68	90
		ii) Minimum Distance	83	99	92	109	62	77	68	90
		iii) Minimum Time with detour via Highway 6 from Guelph	(87)	(117)	(96)	(127)	(64)	(81)	(70)	(94)
		iv) Minimum Time with detour via Highway 401 at Cambridge and Highway 6 where applicable	* (87)	(108)	* (95)	(123)	N/A	N/A	N/A	N/A
44	Brantford	i) Minimum Time	* 52	59	* 72	85	* (75)	(98)	* (81)	(111)
		ii) Minimum Distance	52	59	72	85	(76)	(97)	(81)	(111)
46	Simcoe	i) Minimum Time	* 38	44	* 79	97	* 87	115	* 96	131
		ii) Minimum Distance	38	44	79	97	87	115	96	131
49	Dunnville	i) Minimum Time	* 52	62	* 32	34	* 79	104	* 88	120
		ii) Minimum Distance	52	62	32	34	79	104	88	120
50	Welland	i) Minimum Time	* 83	104	* 44	51	* 85	121	* 94	137
		ii) Minimum Distance	83	104	44	51	85	121	94	137
53	St. Catharines	i) Minimum Time	* 74	98	* 38	46	* 71	99	* 80	115
		ii) Minimum Distance	74	98	38	46	71	99	80	115
54	Grimsby	i) Minimum Time	* 54	70	* 18	18	* 51	71	* 60	87
		ii) Minimum Distance	54	70	18	18	51	71	60	87
55	Hamilton	i) Minimum Time	* 46	53	* 36	(35)	* 43	54	* 52	70
		ii) Minimum Distance	46	53	(37)	34	43	54	52	70
57	Oakville	i) Minimum Time	* 59	79	* 59	81	* 26	28	* 25	28
		ii) Minimum Distance	59	79	60	80	26	28	25	28
58	Milton	i) Minimum Time	* 67	89	* 68	91	* 18	18	* 24	31
		ii) Minimum Distance	68	89	68	90	18	18	24	31
60	Mississauga	i) Minimum Time	* 76	96	* 76	98	* 43	45	* 21	13
		ii) Minimum Distance	76	96	77	97	43	45	21	13

TABLE D-4: COMPARISON OF ALTERNATIVE ROUTES TO CANDIDATE RECEIVER SITES (continued)

			CANDIDATE RECEIVER SITES							
			NIAGARA REGION Hagersville		NIAGARA REGION Smithville		TOWN OF MILTON		BRAMPTON-MISSISSAUGA	
Zone Number	Source Zone	Route Description	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)
61	Brampton	i) Minimum Time	* 79	111	* 77	113	* 44	52	* 22	19
		ii) Minimum Distance	80	106	81	107	44	52	22	19
63	Orangeville	i) Minimum Time	* 105	146	* 103	148	* 66	76	* 48	55
		ii) Minimum Distance	113	141	107	143	66	76	48	55
68	Barrie	i) Minimum Time	* 129	191	* 129	193	* 96	140	* 74	108
		ii) Minimum Distance	129	191	130	192	96	140	74	108
74	Aurora	i) Minimum Time	* 90	132	* 90	134	* 57	81	* 35	35
		ii) Minimum Distance	90	132	91	133	57	81	49	49
78	Toronto	i) Minimum Time	* 89	124	* 89	126	* 56	73	* 34	41
		ii) Minimum Distance	89	124	90	125	56	73	34	41
82	Oshawa	i) Minimum Time	* 116	171	* 116	173	* 83	120	* 61	88
		ii) Minimum Distance	116	171	117	172	83	120	61	88
88	Lindsay	i) Minimum Time	* 164	239	* 164	241	* 131	188	* 109	156
		ii) Minimum Distance	166	231	167	232	133	180	111	148
89	Cobourg	i) Minimum Time	* 149	229	* 149	231	* 116	178	* 94	146
		ii) Minimum Distance	149	229	150	230	116	178	94	146
92	Peterborough	i) Minimum Time	* 166	244	* 166	246	* 133	193	* 111	161
		ii) Minimum Distance	166	244	167	245	133	193	111	161
98	Huntsville	i) Minimum Time	* 214	319	* 214	321	* 181	268	* 159	236
		ii) Minimum Distance	214	319	215	320	181	268	159	236
101	Belleville	i) Minimum Time	* 194	299	* 194	301	* 161	248	* 139	216
		ii) Minimum Distance	194	299	195	300	161	248	139	216
106	Kingston	i) Minimum Time	* 246	372	* 246	374	* 213	321	* 191	289
		ii) Minimum Distance	246	372	247	373	213	321	191	289
109	Brockville	i) Minimum Time	* 292	455	* 292	457	* 259	404	* 237	372
		ii) Minimum Distance	292	455	293	456	259	404	237	372

TABLE D-4: COMPARISON OF ALTERNATIVE ROUTES TO CANDIDATE RECEIVER SITES (continued)

Zone Number	Source Zone	Route Description	CANDIDATE RECEIVER SITES NIAGARA REGION Hagersville		NIAGARA REGION Smithville		TOWN OF MILTON		BRAMPTON- MISSISSAUGA	
			Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)	Time (min)	Distance (km)
117	Ottawa	I) Minimum Time	368	529	368	531	335	478	313	446
		II) Minimum Distance	372	520	373	521	339	469	317	437
		III) Minimum Time with detour via Highway 16 - Highway 401	* 381	573	* 381	575	* 348	522	* 326	490
121	Cornwall	I) Minimum Time	* 350	550	* 350	552	* 317	499	* 295	467
		II) Minimum Distance	350	550	351	551	317	499	295	467
125	Hawkesbury	I) Minimum Time	* 411	632	* 411	634	* 378	581	* 356	549
		II) Minimum Distance	447	614	448	615	414	563	392	551
143	North Bay	I) Minimum Time	* 311	448	* 311	450	* 278	397	* 256	365
		II) Minimum Distance	311	448	312	449	278	397	256	365
145	Sudbury	I) Minimum Time	* 346	495	* 346	497	* 313	444	* 291	412
		II) Minimum Distance	346	495	347	496	313	444	291	412
151	Sault Ste. Marie	I) Minimum Time	* 537	796	* 537	798	* 504	745	* 482	713
		II) Minimum Distance	537	796	538	797	504	745	482	713
154	Kirkland Lake	I) Minimum Time	* 465	692	* 465	694	* 432	641	* 410	609
		II) Minimum Distance	465	692	466	693	432	641	410	609
159	Cochrane	I) Minimum Time	* 544	820	* 544	822	* 511	769	* 489	737
		II) Minimum Distance	544	820	545	821	511	769	489	737
174	Thunder Bay	I) Minimum Time	* 955	1 507	* 995	1 509	* 962	1 456	* 940	1 424
		II) Minimum Distance	1 009	1 394	1 010	1 395	976	1 343	954	1 311

NOTE: Unless otherwise indicated, all values were obtained from P50 ('MOTORS' Program) impedance matrices

( ) Time and Distance values computed by hand: refer to working file

* Preferred Route Selection

Other criteria will be considered in conjunction with time and distance in selecting the preferred routes.

3. ALTERNATIVE ROUTES

In several cases, it was found that a time or distance route was potentially acceptable except for a particular link or series of links along its path. Therefore, alternative routes were chosen and compared, on a time and distance basis, with minimum time and distance routes. These alternatives are also shown on Table D-4.

OTTAWA TO ALL CANDIDATE RECEIVER SITES

Both the minimum time and distance routes utilize a long stretch of Highway 7, passing through sensitive lake lands and small rural communities. However, the use of Highway 16 to Highway 401 was chosen as an alternative route to be considered for the following reasons:

- removes truck traffic from environmentally sensitive Highway 7;
- minimizes time and distance on non-freeway routes;
- increases percentage of time and distance spent on the preferred Highway 401;
- Highway 401 is preferred as it has higher speeds, less stops and starts, and is considered to be less sensitive environmentally.

As shown in Table D-4, the alternative route is approximately 9 minutes longer and 53 km farther than the minimum distance route, and 13 minutes longer and 44 km farther than the minimum time route.

Although this route was found to be longer in both time and distance, it is the safer route from an environmental viewpoint and therefore an important alternative to be considered.

ST. THOMAS TO HAGERSVILLE CANDIDATE RECEIVER SITE

Highway 3 from St. Thomas to Jarvis is utilized for both the minimum time and distance routes. This route is complicated by the presence of many moderately populated communities. A viable alternative via Highway 401, Highway 403 and Highway 54 was chosen for investigation. It was found to be 8 minutes longer and 32 km farther than the minimum time and distance routes.

KITCHENER-WATERLOO TO HAGERSVILLE AND SMITHVILLE CANDIDATE RECEIVER SITES

Both minimum time and distance routes use Highway 8 south of Highway 401. This may be potentially unacceptable as it passes through the City of Cambridge. An alternative route diverting traffic via Highway 401 to Highway 6 south was investigated. Results show that it is 4 minutes longer and 9 km farther than the minimum time and distance routes to Hagersville candidate site, and 3 minutes longer and 14 km farther than the minimum time and distance routes to Smithville candidate site. It can be considered a viable alternative route.

STRATFORD TO SMITHVILLE CANDIDATE RECEIVER SITE

Minimim time and distance routes also use Highway 8, south of Highway 401 through the City of Cambridge. In the event that this is an unsatisfactory route, two alternatives have been investigated.

The first alternative by-passes Cambridge via Highway 401 and Highway 6.

The second alternative route uses Highway 59 to Highway 401, then Highway 401 to Highway 403 and into the site via Highways 20/53.

Both of these routes yield negligible differences in time and distance to those routes using Highway 8 through Cambridge. The first alternative route was therefore selected.

4. CONCLUSIONS

The investigation of routes was based on minimal criteria: time, distance, and environmental sensitivity.

The various alternative routes presented in this chapter have been developed based on preliminary information regarding network source points and candidate receiver sites. In determining these alternatives, it was found that minimum time and distance routes are sensitive to the location of the origin and destination zones. As a result a time or distance route could be altered if more precise information becomes available on waste source point location.

Based on the criteria and the information available at this phase, the alternative routes presented in Table D-4 were considered in the preferred route selection process.

The investigation thus far has also provided the basis for on-going analysis of the Ontario-wide transport network to be used by vehicles transporting hazardous liquid, industrial waste and other hazardous wastes. The next phase of the investigation is to focus on specific areas of refinement, including:

- the addition of waste receiver zones which would be representative of a large number of OWMC candidate receiver facility sites within the overall candidate areas, and
- additional refinements to the road system haulage network to best serve the candidate sites and to minimize environmental impacts.

CHAPTER D.5
INTRODUCTION TO PREFERRED ROUTE REFINEMENT

1. OBJECTIVES

This documents the methodology and results of the preferred route refinement phase of the transportation study to determine the preferred truck routes for the transportation of hazardous liquid industrial waste and hazardous waste from municipal source sites to OWMC treatment and disposal sites. This second step in the investigation of alternative routings and the addition of receiver nodes will be used for comparative evaluation of OWMC potential receiver facility sites.

The objectives of this phase of the study are:

- to review the truck routes identified during the preceding phase and to carry out additional routing modifications as may be required;
- to update the minimum path highway network program to reflect the desired preferred routings;
- to add hypothetical candidate receiver sites to better reflect the wide geographical spread of the candidate area;
- to establish the methodology to be applied for the comparative evaluation of transportation costs in relation to possible OWMC facilities receiver sites;
- to establish the methodology to be applied for the comparative evaluation of transportation risks in relation to possible OWMC facilities receiver sites.

2. OVERVIEW

This investigation was carried out based upon the following steps:

- identification of a need to modify minimum time or distance routes to avoid other sensitive areas;
- refinement of the Ontario highway network to produce preferred truck routings;
- deletion of two cluster centroid receiver areas and the addition of five new cluster centroids;
- identification of a waste volume scenario to be used as an input to the calculation of a proxy for transportation costs;
- identification of an accident risk input to the calculation of a proxy for accident frequency.

It is emphasized that the results of this analysis were based on the most recent information available regarding network source points and candidate receiver areas. The seven cluster centroids chosen were deemed to best represent all the potential receiver sites. However, it is to be noted that at a later stage, the need for additional cluster centroids was identified. These are dealt with in a subsequent phase; Addition of Receiver Areas.

The term "cluster centroid" and/or "receiver centroid" are used interchangeably in this document. In a transportation analysis involving the construction of computerized road networks, the term centroid is used to describe points of travel origin or destination.

In the specific application of developing a provincial road network for the OWMC analysis, centroids were established for each of the 43 municipal waste origin areas where special wastes requiring treatment are produced. As discussed in Chapter D.4, four cluster centroids were identified for the preliminary analysis of the preferred routes from source to receiver areas. Following this and in accordance with the work program requirements, three additional cluster centroids were introduced within the Niagara Peninsula area, to better represent all possible OWMC facility site locations.

As may be deduced from prior discussion, the term "cluster centroid" was intended to identify the location of a receiver site which would be representative of a group or cluster of identified candidate sites within the same general geographical area. The rationale for this procedure was that too many possible receiver and treatment sites would be identified during Phase 3 of the site selection process to model on a cost effective basis. Therefore, it was decided to locate a cluster centroid within each geographic area of the candidate areas in the Niagara Region.

CHAPTER D.6
ADDITIONAL RECEIVER CENTROIDS

1. INTRODUCTION

The initial four receiver centroids, adopted for purposes of network building as discussed in the preceding section, were sited without any specific knowledge of the location of possible candidate sites. The four locations selection sought to provide an overview of highway routings. Thus, one centroid was located within the candidate area in Mississauga, one within the Milton area, and two within the western sector of the Niagara Peninsula at Hagersville and Smithsville.

At this stage in the site selection process, candidate sites were just starting to emerge. Based upon this initial information it became apparent that some modifications in Niagara Peninsula centroids would be required.

The changes introduced are identified in this chapter.

2. CENTROID REVISIONS

MISSISSAUGA CENTROID

This cluster centroid was located originally at the junction of Highway 401 and Highway 10.

Based upon initial facility site identification, the location was judged to be satisfactory for on-going analysis.

MILTON CENTROID

This cluster centroid was located originally on Highway 25, to the south of urbanized Milton and near the Omagh community.

Based upon the preliminary site locations identified, it was judged to be a suitable location for future initial comparative analysis.

DELETED CENTROIDS

An inspection of the first group of potential facility sites within the Niagara Peninsula revealed that both the Hagersville and Smithsville cluster centroids, established earlier for road network testing, did not necessarily represent optimum locations. As the intention was to establish five cluster centroids, each of which would be a suitable surrogate for a grouping of sites within five sectors of the Niagara Peninsula, it was decided to delete Hagersville and Smithsville and to establish five new cluster centroids to suit the objective.

NEW CENTROIDS

At this point, not all possible candidate sites had been identified. However, based upon the information available at that time, the Niagara Peninsula was divided into a total of five sectors based upon the initial sites identified and the candidate area identification from the Interim Phase 3 Report.

The new cluster centroids, as well as those retained from the previous phase of transportation analysis, are tabulated below.

Centroid No.	Cluster Centroid Name	Site Location Description
44	Caledonia	Intersection of Highways 6 and 54
45	Binbrook #1	Binbrook Road East at H-W/Niagara Boundary
46	Bismarck	On Highway 20 Bismarck
47	Welland	Intersection of Highway 58 and 58A
48	Niagara Falls S.	Intersection Niagara RR98 and 47
49	Milton	On Highway 25 near Omagh
50	Mississauga	Junction of Highways 401 and 10

CHAPTER D.7
THE REFINEMENT OF ROUTES

1. INTRODUCTION

The addition of new cluster centroids within the Niagara Peninsula area necessitated the addition of a number of new road links to connect with the centroids. Due to these changes as well as the desirable network revisions, further adjustments were made to the Ontario Highway network.

The required network modifications are discussed in this chapter.

2. ONTARIO HIGHWAY NETWORK UPDATE

The highway network as developed for the Preferred Route Selection phase of the investigation required more detailed review due to:

- removal of two cluster centroids
- addition of five cluster centroids, and
- addition of arterial road links to provide connections to the new cluster centroids

Adjustments were made to the MOTORS program network so that the chosen routings would be the same as the preferred routes identified earlier. All other routes followed the minimum time path. A description of the route adjustments, the rationale for the change and the effect on time and distance are set out hereafter.

OTTAWA AREA ROUTINGS

The network was altered in the following manner. A link on the minimum time route, as chosen by MOTORS, was removed to route the Ottawa traffic south on Highways 16 to 401 instead of along Highways 417 to 7 to 37 to 401.

This change results in an extra 13 minutes of travel time and an extra 44 km to each receiver area. The minimum time and distance routes utilize a large section of Highway 7. Due to the existence of lake land and numerous small communities, the Highway 7 routing was not desirable. The preferred route along Highways 16 to 401 travels through fewer small towns and uses a 400-series freeway for a large portion of the journey.

HAMILTON AREA ROUTINGS

Changes were made to reroute traffic that previously went through downtown Hamilton via Highway 6 and 8. A link on Highway 6 south of the escarpment was removed and another was added from Highway 6 north of the escarpment to Highway 403. Traffic will now move from Highway 6 to Hamilton-Wentworth Regional Road 215 (Mohawk Road) to Highway 403, or vice versa, avoiding the downtown area and crossing the escarpment on Highway 403 - a preferable crossing.

This routing modification produced minor increases in travel time and distance for several routing combinations including the cluster centroids located at:

- 44 Caledonia
- 45 Binbrook
- 46 Bismarck
- 49 Milton
- 50 Mississauga

With respect to the first three receiver locations, the major trip routing affected is that from the Kitchener-Waterloo, Owen Sound, Walkerton and Guelph areas. Due to the routing changes, travel time is increased from 2 to 4 minutes and travel distance from no change up to a 13 km increase.

In the case of Milton and Mississauga centroids, the routing modification only affects the trip interchange from Simcoe. The change adds 4 minutes of travel and a distance penalty of 5 km.

ST. THOMAS AREA ROUTINGS

The minimum time paths from St. Thomas to all receive area in the Niagara Peninsula, except Welland, follows Highway 4 to Highway 401 to Highway 403. The route to Welland is along Highway 3 across the Niagara Peninsula. The preferred route to the Welland area follows the same route as all the others, Highway 4 to Highway 401 to Highway 403. This adds 3 minutes and 29 km to the route but significantly reduces the distance travelled on the Kings Highway in favour of the 400-series freeway and reduces the amount of travel through small towns. To ensure the selection of the preferred routing, a link was removed from Highway 3 to divert the haulage of waste along Highway 4 to Highway 401.

CHAPTER D.8
ADDITION OF RECEIVER CENTROIDS

1. INTRODUCTION

As Phase 3 of the site selection process advanced, it became apparent that there were a large number of potential candidate sites within the candidate area. The prior decision to evaluate all sites based upon seven cluster centroids was reviewed within the context of sites that were identified for screening. The number of sites involved is in excess of 50 separate locations.

When all locations were reviewed in relation to the seven cluster centroids it was determined that ten new cluster centroids should be added to provide a reasonable representation of the scatter of potential sites within the candidate area. One of the ten new cluster centroids was within the A-1 area (Brampton) which was added to the site selection process in January 1984.

This chapter identifies the location of the added cluster centroids that were used in the initial comparative evaluation activity. The methodology employed in the production of tonne-kilometre data is also described.

2. NEW RECEIVER CENTROIDS

By visual inspection of the potential sites as developed during the screening of areas activity, it was possible to discern the potential sites which were not well represented by the original cluster centroids established in the preceding phase. To provide a good representation of all potential sites it was determined that ten new receiver centroids be established.

One of the new centroids was located within the A-1 area (Brampton) to provide transportation related data in the newly expanded candidate area identified by the Corporation during January 1984. The remaining nine new centroids were then strategically located within the Niagara Peninsula area to provide an acceptable representation of the potential sites identified.

The addition of new cluster centroids also required modifications to the Ontario network adopted during the development of the preferred route refinement phase. Generally, the changes involved the addition of major access route links to connect the ten centroids into the provincial network. This was necessary because the original network was an incomplete skeletal network. It included all 400-series and other provincial highways and selected regional or municipal arterial roadways. In the area of the Niagara Peninsula, the number of north-south arterial road connectors was constrained due to recognized difficulties at points where many of the available roads crossed the Niagara Escarpment. Consequently, for purposes of Phase 3 of the site selection process only a minimum number of roads were linked into the system. It is recognized that additional linkages are both possible and acceptable from a traffic use viewpoint; however, these were not required to permit the initial comparative evaluation of sites based upon the use of cluster centroids.

During Phase 4 of the site selection process, it is intended to increase the number of acceptable road links to each of the candidate sites that are carried forward into detailed comparative evaluation. The environmental evaluation of alternative access routes conducted as a part of initial comparative evaluation will provide essential background information as to the regional arterial links that should be included in the refined system network.

Figure II-1, in Part II of the text portrays the basic arterial road system that was established and used in the MOTORS transportation package program P40 Minimum Paths routine. This was the network to which travel between all municipal source sites and the cluster centroid receiver areas occurred.

Figure II-1 also identifies the location of the original seven cluster centroids, listed on page D-33, plus the ten new centroids added during this phase. The earlier identified centroids are numbered 44 through 50 and the new centroids are within the group 51 through 60. The new centroid locations are:

Centroid No.	Cluster Centroid Name	Site Location Description
51	Carluke	Intersection of Sawmill Road and Carluke Road
52	Binbrook #2	Intersection of HW 622 and Highway 56
53	Empire Corners	H-N #19, 3 km west of Empire Corners
54	Caistor Centre	NR #65, 2 km west of NR #14
55	Winslow	NR #65, 0.5 km west of NR #16
56	Elcho	1.5 km east of NR #16 on Elcho Road
57	Boyle	Intersection of Highway 20 and NR #24
58	Chambers Corners	3 km west of NR #24 on Wilford Road
59	Wainfleet	1.5 km west of Highway 3 on Abbey Road south
60	Bramalea	Intersection of Highway 7 and Airport Road

3. TRAVEL DISTANCE METHODOLOGY

Following the updating of the access road network and the addition of the ten new receiver centroids, a new computer output was produced giving the travel distance from each municipal special waste source site to each of the ten new receiver site locations. These distances were retained in the MOTORS transportation package file P40. The printout of these data is shown in Figure D-2. This includes the travel distance from all source sites to each of the seventeen cluster centroids. Table D-5 lists the source and receiver site numbers with the corresponding names.

The waste quantity computer file P50 was then combined with the updated P40 file described above, and a further output was produced for each of the cluster centroids. This output was the tonne-kilometres required for the haulage of waste from each source to each receiver centroids. This provided an essential input to the comparative evaluation of sites.

In addition to the total tonne-kilometres of haulage produced for each site cluster combination, a further breakdown was produced of tonne-kilometres by road link type. This input is required for the accident frequency index calculations.

TABLE D-5

OWMC SOURCE SITES AND RECEIVER CENTROIDS

SOURCE SITES

SITE #	CITY/TOWN	SITE #	CITY/TOWN	SITE #	CITY/TOWN
1	Windsor	15	St. Thomas	30	Brockville
2	Brantford	16	Orangeville	31	Walkerton
3	Simcoe	17	Barrie	32	Ottawa
4	Dunville	18	London	33	Cornwall
5	Welland	19	Aurora	34	Hawkesbury
6	St. Catharines	20	Toronto	35	Owen Sound
7	Grimsby	21	Oshawa	36	North Bay
8	Hamilton	22	Woodstock	37	Sudbury
9	Chatham	23	Lindsay	38	Sault Ste. Marie
10	Oakville	24	Stratford	39	Kirkland Lake
11	Sarnia	25	Cobourg	40	Cochrane
12	Milton/Halton Hills	26	Peterborough	41	Guelph
		27	Huntsville	42	Kitchener-Waterloo
13	Mississauga	28	Belleville	43	Thunder Bay
14	Brampton	29	Kingston		

RECEIVER CLUSTER CENTROIDS

CENTROID #	CITY/TOWN	CENTROID #	CITY/TOWN	CENTROID #	CITY/TOWN
44	Caledonia	50	Mississauga	56	Elcho
45	Binbrook #1	51	Carluke	57	Boyle
46	Bismarck	52	Binbrook #2	58	Chambers Corners
47	Welland	53	Empire Corners		
48	Niagara Falls	54	Caistor Centre	59	Wainfleet
49	Milton	55	Winslow	60	Bramalea

SOURCE SITES

RECEIVER CLUSTER CENTROIDS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
44	317	46	48	52	94	88	60	43	235	75	226	85	92	107	145	142	187	131	128	120	167	78	235	120	225
45	341	70	75	48	72	67	39	30	259	68	250	78	85	100	169	135	180	155	121	113	160	102	228	144	218
46	359	89	103	40	39	43	24	49	277	87	268	97	104	119	187	154	199	173	140	132	179	120	247	169	237
47	399	128	119	50	11	41	61	86	317	124	308	134	141	156	227	191	236	213	177	169	216	160	284	206	274
48	409	138	153	73	37	35	55	80	327	118	318	128	135	150	237	185	230	223	171	163	210	170	278	200	268
49	351	93	121	104	121	99	71	54	269	28	260	18	45	52	179	76	141	165	32	74	121	112	189	116	179
50	364	111	137	120	137	115	87	70	282	28	273	31	13	19	192	55	108	178	49	41	88	125	156	129	146
51	313	42	61	60	83	87	59	42	231	67	222	77	84	99	141	134	179	127	120	112	159	74	227	106	217
52	331	60	67	42	67	71	43	26	249	64	240	74	81	96	159	131	176	145	117	109	156	92	224	124	214
53	330	59	61	37	78	82	54	37	248	75	239	85	92	107	158	142	187	144	128	120	167	91	235	133	225
54	346	75	82	31	50	54	26	40	264	78	255	88	95	110	174	145	190	160	131	123	170	107	238	139	228
55	354	83	90	25	44	49	21	46	272	84	263	94	101	116	182	151	196	168	137	129	176	115	244	147	234
56	357	86	93	22	47	52	26	51	275	89	266	99	106	121	185	156	201	171	142	134	181	118	249	150	239
57	368	97	102	37	30	34	33	58	286	96	277	106	113	128	196	163	208	182	149	141	188	129	256	161	246
58	379	108	95	26	41	45	44	69	297	107	288	117	124	139	207	174	219	193	160	152	199	140	267	172	257
59	380	109	98	29	32	46	45	70	298	108	289	118	125	140	208	175	220	194	161	153	200	141	268	173	258
60	382	118	151	134	151	129	101	84	300	42	291	49	31	16	210	51	96	196	37	47	94	143	137	147	152

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
44	240	315	295	368	451	193	570	546	628	223	444	491	792	688	816	84	95	1503
45	233	308	288	361	444	200	563	539	621	230	437	484	785	681	809	91	102	1496
46	252	327	307	380	463	219	582	558	640	249	456	503	804	700	828	110	130	1515
47	289	364	344	417	500	256	619	595	677	286	493	540	841	737	865	147	167	1552
48	283	358	338	411	494	250	613	589	671	280	487	534	835	731	859	141	161	1546
49	194	269	249	322	405	166	524	500	582	196	398	445	746	642	770	57	77	1457
50	161	236	216	289	372	162	491	467	549	169	365	412	713	609	737	70	90	1424
51	232	307	287	360	443	181	562	538	620	211	436	483	784	680	808	72	67	1495
52	229	304	284	357	440	196	559	535	617	226	433	480	781	677	805	87	85	1492
53	240	315	295	368	451	207	570	546	628	237	444	491	792	688	816	98	93	1503
54	243	318	298	371	454	210	573	549	631	240	447	494	795	691	819	101	100	1506
55	249	324	304	377	460	216	579	555	637	246	453	500	801	697	825	107	108	1512
56	254	329	309	382	465	221	584	560	642	251	458	505	806	702	830	112	111	1517
57	261	336	316	389	472	228	591	567	649	258	465	512	813	709	837	119	122	1524
58	272	347	327	400	483	239	602	578	660	269	476	523	824	720	848	130	133	1535
59	273	348	328	401	484	240	603	579	661	270	477	524	825	721	849	131	134	1536
60	167	224	222	295	378	158	497	473	555	165	353	400	701	597	725	88	108	1412

Fig. D-3 Distance from Source Sites to Receiver Cluster Centroids (km)

APPENDIX E
TRANSPORTATION SITE AREA SCREENING SUMMARY

TABLE E-1
SITE AREA SCREENING - TRANSPORTATION
(Cost and Accident Indices for the 17 Receiver Centroids)

RECEIVER CENTROIDS				SITE AREAS ASSOCIATED WITH EACH RECEIVER CENTROID	
Number	Name	Cost Index (and Rank)	Accident Index (and Rank)	Landfill	Physical/ Chemical Incinerator
44	Caledonia	1.26 (8)	1.31 (4)	None	None
45	Binbrook #1	1.22 (6)	1.39 (7)	LF-3W LF-6W LF-7W LF-8W LF-9W LF-16C LF-28C	PI-5C PI-18C PI-19C
46	Bismarck	1.34 (12)	1.53 (11)	LF-9C LF-17C LF-18C LF-19C LF-23C LF-25C LF-29C LF-30C	PI-10C PI-11C PI-25C
47	Welland	1.49 (16)	1.45 (8)	LF-1C LF-4C LF-5C LF-2E LF-6E LF-7E LF-8E LF-11E	PI-16C PI-17C PI-17E PI-18E PI-19E PI-20E PI-21E PI-22E PI-34E PI-35E PI-36E

TABLE E-1
SITE AREA SCREENING - TRANSPORTATION
(Cost and Accident Indices for the 17 Receiver Centroids)
(continued)

RECEIVER CENTROIDS				SITE AREAS ASSOCIATED WITH EACH RECEIVER CENTROID	
Number	Name	Cost Index (and Rank)	Accident Index (and Rank)	Landfill	Physical/ Chemical Incinerator
48	Niagara Falls	1.55	1.46	LF-1E	PI-1E
				LF-3E	PI-2E
		(17)	(10)	LF-4E	PI-3E
				LF-5E	PI-4E
				LF-9E	PI-5E
				LF-10E	PI-6E
				LF-12E	PI-7E
					PI-8E
					PI-9E
					PI-10E
					PI-11E
					PI-12E
					PI-13E
					PI-14E
					PI-15E
					PI-16E
					PI-23E
					PI-24E
					PI-25E
					PI-26E
					PI-27E
					PI-28E
					PI-29E
					PI-30E
					PI-31E
					PI-32E
					PI-33E
					PI-37E
49	Milton	1.08	1.09	LF-1N	PI-1N
		(2)	(3)	LF-4N	PI-2N
				LF-5N	PI-7N
					PI-8N
					PI-10N
					PI-11N
					PI-12N
					PI-13N
					PI-14N
					PI-15N

TABLE E-1

SITE AREA SCREENING - TRANSPORTATION

(Cost and Accident Indices for the 17 Receiver Centroids)

(continued)

RECEIVER CENTROIDS				SITE AREAS ASSOCIATED WITH EACH RECEIVER CENTROID	
Number	Name	Cost Index (and Rank)	Accident Index (and Rank)	Landfill	Physical/ Chemical Incinerator
50	Mississauga	1.00 (1)	1.00 (1)	LF-2N LF-3N	PI-3N PI-4N PI-5N PI-6N PI-9N
51	Carluke	1.20 (5)	1.45 (9)	LF-5W LF-10W LF-11W	PI-2W PI-3W PI-4W PI-5W
52	Binbrook #2	1.16 (4)	1.31 (5)	LF-4W LF-14W	PI-6W
53	Empire Corners	1.22 (7)	1.38 (6)	LF-1W LF-2W LF-12W LF-13W	PI-1W
54	Caistor Centre	1.28 (9)	1.69 (13)	LF-12C LF-13C LF-26C LF-27C LF-32C	PI-2C PI-4C PI-6C PI-7C PI-20C
55	Winslow	1.32 (10)	1.70 (14)	LF-21C LF-22C LF-24C LF-31C	PI-1C PI-8C PI-9C PI-21C PI-22C
56	Elcho	1.34 (11)	1.93 (15)	LF-3C	PI-26C
57	Boyle	1.39 (13)	1.66 (12)	LF-7C LF-8C LF-10C LF-11C LF-20C	PI-12C PI-13C PI-23C

TABLE E-1
SITE AREA SCREENING - TRANSPORTATION
(Cost and Accident Indices for the 17 Receiver Centroids)
(continued)

RECEIVER CENTROIDS				SITE AREAS ASSOCIATED WITH EACH RECEIVER CENTROID	
Number	Name	Cost Index (and Rank)	Accident Index (and Rank)	Landfill	Physical/ Chemical Incinerator
58	Chambers Corners	1.46 (14)	1.98 (17)	LF-6C LF-15C	PI-3C PI-24C
59	Wainfleet	1.47 (15)	1.96 (16)	LF-2C LF-14C	PI-14C PI-15C
60	Bramalea	1.09 (3)	1.09 (3)	LF-1A1 LF-2A1	PI-1A1 PI-2A1 PI-3A1

GENERAL NOTE: Suitability screen factors and one additional system screen factor are displayed in Appendix Table E-2

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^3 1:50 000	MAP SCALE FOR SCREENING^3 1:10 000	SUITABILITY AND SYSTEM SCREEN FACTORS: TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: AIRPORT FACILITY CONFLICT WITH SITE AREA	SYSTEM SCREEN FACTOR^{1,2}: TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
NORTH LANDFILL OR INTEGRATED							
LF-1A1		0	Local underground hydro and water main in southern part.	No road closures required except those under construction on-site. R.R. #7 (Airport Road) forms the western border of site. Highway 7 is 800 m south.	None	None	N/A
LF-2A1		0	Local underground Bell line along west side of Torbram Road.	R.R. #14 forms part of the site's northern border. Highway 7 is approximately 6 km south. Torbram Road (local) runs through site.	None	None	N/A
LF-1N		0	No utilities cross site.	R.R. #22 and R.R. #6 are the west and south site boundaries. Approximately 7.5 km to Highway 401 an 11.5 km to QEW.	CNR line flanks site.	None	N/A
LF-2N		0	Hydro line runs along north boundary.	Highway 401 is 1 km south and Highway 10 runs east of site with R.R. #5 (Derry Road) on north west side.	None	Pearson International Airport is 5 km east of site. Runway zoning limits smokestack height of PI from 43 to 58 m (140 ft. to 190 ft.).	N/A
LF-3N		0	Local hydro through site. Major Hydro line borders south side.	R.R. #5 (Derry Road) borders the north side of site. Highway 401 is 2 km south. Highway 410 runs through east end.	None	Pearson International Airport is 4 km east with main E-W runway 2+ km to the east of Tomkin Road. Airport runway zoning restricts PI smoke stack height to 83.2 m (373 ft.)	N/A
LF-4N		0	No utilities cross site (local utilities excepted).	R.R. #22 flanks east side and R.R. #6 runs through south side. Approximately 7.5 km to 401 and 11.5 km to QEW.	CNR track approximately 900 m east of site and runs parallel to east boundary.	Local airport in vicinity unlikely to suffer navigational constraint.	N/A
LF-5N	0		Bisected by high pressure oil pipeline.	Bisected by Regional Road 6. Highway 25 crosses south part of site. Approximately 6.0 km to Highway 401 and 10 km to QEW.	CNR track near west boundary.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING³		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR1,2
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
WEST LANDFILL OR INTEGRATED							
LF-1W	0		Gas pipeline along western flank of site on Highway 56.	Highway 56 flanks east side of site. R.R. #9 is 2 km north.	CN Rail approximately 1 km southwest of site.	None	N/A
LF-2W		0	No utilities cross site (local utilities excepted)	R.R. #9 flanks north side. Highway 56 runs parallel to east side and is approximately 400 m to the east.	CN Line located 1.6 km. Southwest of site.	None	N/A
LF-3W		0	Hydro transmission line along north site boundary.	R.R. #622 runs east/west just north of site; Glanbrook-West Lincoln Townline forms east site boundary. Access from site via R.R. #622, Highway 56 and Highway 20. Closure of Kirk Road (local) between Glanbrook-West Lincoln Townline West for 1.4 km is required.	None	None	N/A
LF-4W		0	Hydro line cuts through central site from west to east.	R.R. #640 on west; R.R. #622 on north; R.R. #614 on south side of site. Access to QEW along Highway 56 north then Highway 20 through Hamilton.	None	None	N/A
LF-5W		0	Hydro transmission line north of site.	Haldimand-Norfolk R.R. #22 runs parallel to west side approximately 800 m west. R.R. #622 forms part of north boundary. Highway 6 is 4.5 km east. Highway 403 is 7.5 km north.	CN Rail line lies 2.3 km to the south.	None	N/A
LF-6W	0		Oil pipeline bisects site in an east-west direction.	R.R. #634 forms part of east site boundary, R.R. #622 (Binbrook Road West) forms south boundary Highway 56 is 3.5 km west and Highway 20 is 4.5 km north.	None	None	N/A
LF-7W		0	Hydro transmission line along south boundary.	R.R. #622 (Binbrook Road East) flanks south side; R.R. #634 flanks east side of site. Highway 56 is 2 km west and Highway 20 is 6 km north.	None	None	N/A
LF-8W	0		Hydro transmission line along north boundary.	Highway 56 is 1 km west; R.R. #622 is 1 km north and R.R. #634 is 2 km east.	None	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-9W	0		Hydro line along north site boundary.	R.R. #634 forms east site boundary. R.R. #622 is 1 km north. Highway 56 is 2 km west and Highway 20 is 7 km north.	None	None	N/A
LF-10W		0	Hydro transmission lines in north-south direction on east side of site and along Mulligan Road. Bell line along Mulligan Road.	Access to east corner of site would use R.R. #222 for 5 km to connect with Highways 2 and 403. Mulligan Road (local) needs to be closed between Baptist Church Road and Sawmill Road.	None	None	N/A
LF-11W		0	Hydro transmission lines through west side of site; local line along Trinity Road (north-south); and along Butter Road (east-west). Local Bell lines run (north-south) along Trinity above ground and (east-west) along Butter below ground.	R.R. #222 (Trinity Road) and Butter Road (local) require closure if whole site is required. Access from site would use R.R. #222 for 2.1 km to connect with Highways 2 and 403.	None	None	N/A
LF-12W	0		No utilities cross site (local utilities excepted).	Highway 54 is approximately 3 km west. R.R. #9 is 1 km north. Highway 56 is 3.7 km east of site.	CNR line at north-east corner of site.	None	N/A
LF-13W		0	No utilities cross site (local utilities excepted).	R.R. #9 along part of north boundary. Highway 54 is approximately 800 m west of site.	CNR line located 900 m northeast of site.	None	N/A
LF-14W		0	Local Hydro and underground Bell line along unnamed north-south road. Gas pipeline adjacent to south edge of site.	Glanbrook-Townline flanks north side of site. Road closure required of unnamed road. Site located 4.5 km west of Highway 56 on Glanbrook-Townline Road.	None	None	N/A
CENTRAL LANDFILL OR INTEGRATED							
LF-1C		0	Hydro transmission lines for short distance on south side along Deek's Road and O'Reilly's Road. Also along Farr's Road through site (north-south). Bell lines underground along Farr's Road and for short distances along Deek's and O'Reilly's Roads.	Three local road closures required: Farr's Road, O'Reilly's Road and Deek's Road between CNR track and Lambert Road. Site access from R.R. #23 just south of site connecting to QEW via R.R. #24 and Highway 58 through Welland to Highway 406.	CNR flanks south side of site. ConRail flanks north side of site. ConRail yard located between Deek's Road and O'Reilly's Road north of main line track.	None if used as landfill only	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-2C		0	Provincial gasline along north boundary.	Best access from Feeder Road West which flanks north boundary and follows blocked feeder canal. Approximately 1.2 km road connects with Highway 3. Using Highway 3 and R.R. #24 to the north an interchange with QEW exists (29 km distance).	None	None	N/A
LF-3C		0	Hydro transmission line bisects site (north-south). A local line is along Krick Road in a north-south direction.	Krick Road (local) north of Zumstein Road for 900 m must be closed, plus private drive located in site. R.R. #63 flanks part of south side and R.R. #16 flanks west side. R.R. #16 provides access to Highway 20, 11 km to the north.	T.H. & B. Railway line located 300 m west of west boundary and runs parallel to west side.	None	N/A
LF-4C	0		No utilities cross site (local services excepted).	R.R. #27 runs along north border of site. Highway 3 is located 500 m of site.	ConRail line splits at northwest border of site with one line along north border and second line cutting through site. CNR line splits at southwest border of site with one line along south border and second line cutting through site.	Welland Port Colborne Airport located 2.0 km northwest of site. Navigational conflicts are anticipated.	N/A
LF-5C	0		No utilities cross site (local services excepted).	R.R. #23 runs east-west through site with 1.0 km requiring closure.	CNR line flanks north border of site.	None	N/A
LF-6C	0		No utilities cross site (local services excepted).	R.R. #27 runs east-west through site requiring closure of 1.1 km. R.R. #20 is located 1.5 km west of site.	None	None	N/A
LF-7C	0		Local hydro lines along Boyle Road. Local Bell line along Boyle Road, underground.	Boyle Road (local) south from T.H.&B. rail line must be closed for 1.1 km to Vaughan Road East. Highway 20 located approximately 300 m north of site. R.R. #63 runs along south edge of site and R.R. #24 runs through east edge of site. Access to QEW from R.R. #24.	T.H.B. Rail line runs diagonally through site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-8C		0	Bell transmission line runs diagonally from northwest to southeast, underground.	R.R. #63 flanks southeast tip of site. R.R. #24 is approximately 2.5 km east and Highway 20 is approximately 1.4 km north of site. Access to QEW from R.R. #24.	T.H.&B. Rail line is 1.3 km north and 2 km east.	None	N/A
LF-9C		0	Bell transmission line runs diagonally from northwest to southeast. Local Hydro to service house just east of Gee Street. Bell and Hydro lines along south and north boundary along streets.	Schram Road and Gee Road must be closed between Highway 20 on the north and Vaughan Road on the south. Highway 20 flanks portion of north side of site. R.R. #24 is 4 km east. Access to QEW from R.R. #24.	T.H.&B. Rail line is approximately 1 km and 1.8 km east.	None	N/A
LF-10C	0		No utilities cross site (local services excepted).	Highway 20 runs east-west through south portion of site requiring closure of 500 m.	T.H.&B. Rail line runs east-west through site.	None	N/A
LF-11C	0		Hydro lines cross site east-west through site.	Highway 20 located 3.2 km south of site. R.R. #69 is located 1.6 km north of site.	None	None	N/A
LF-12C		0	Hydro transmission line through south side of site, (east-west direction) also along road through centre of site (local) (north-south direction). Local Bell line below ground along road in centre of site.	Local road closure through centre of site (name unknown). R.R. #14 is 1.5 km east of site. R.R. #6 is 2.5 km west of site. Access to QEW follows R.R. #14 to Highway 20 to R.R. #12 to QEW.	None	None	N/A
LF-13C		0	Hydro lines along north edge of site.	R.R. #65 (Bismarck Road) runs along north edge of site. R.R. #14 is located 500 m east of site.	None	None	N/A
LF-14C	0		No utilities cross site (local services excepted).	Highway 3 located 1.5 km north of site and 2.0 km east of site.	None	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-15C		0	Local Hydro and underground Bell line along all roads identified for potential closures.	R.R. #24 located 500 m east of site. Highway 3 located 1.5 km south of site. R.R. #27 located 1.0 km north of site. Road closures required - 3.7 km of Concession Road 6; 2.1 km of Concession Road 5; 1.4 km of Side Road 34; 1.7 km of Side Road 32; 0.8 km of Perry Road; 1.7 km of Side Road 28; 3.1 km of Traver Road; 1.9 km of two mud roads (names unknown).	ConRail line (double-track) runs east-west through site. CNR line (single-track) located 200 m south of site.	None	N/A
LF-16C	0		No utilities cross site (local services excepted).	R.R. #65 (Bismarck Road) adjacent to southwest corner of site at Hamilton-Wentworth/Niagara border and runs east-west 250 m south of site.	None	None	N/A
LF-17C	0		Hydro line crosses north-south through central part of site.	R.R. #65 (Bismarck Road) along south border of site. Highway 20 located 1.5 km east of site. R.R. #16 located 1.8 km west of site.	T.H.&B. Rail line located 1.5 km west of site.	None	N/A
LF-18C		0	Hydro and underground Bell line along R.R. #27.	Highway 20 located 2.4 km north of site. R.R. #27 requires closure of 700 m.	None	None	N/A
LF-19C	0		Hydro line crosses north-south through westerly part of site. Bell line crosses east-west through centre of site.	Highway 20 runs across easterly portion of site requiring closure of 1.0 km. R.R. #65 (Bismarck Road) flanks south border of site.	T.H.&B. rail line located 1.2 km north of site.	None	N/A
LF-20C	0		Hydro line crosses east-west through north section of site.	Highway 20 located 1.4 km south of site. R.R. #67 located 1.9 km north of site.	T.H.&B. Rail line runs east-west through southwest corner of site.	None	N/A
LF-21C	0		No utilities cross site (local services excepted).	R.R. #65 (Bismarck Road) divides south section from north part of site. R.R. #16 (Vaughan Road) located 500 m east of site.	T.H.&B. Rail line located 600 m east of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING[3] 1:50 000	1:10 000	SUITABILITY AND SYSTEM SCREEN FACTORS: TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	SYSTEM SCREEN FACTOR[1,2] TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-22C	0		Hydro lines run north of site.	R.R. #16 runs through site north-south requiring closure of 2.0 km. R.R. #65 (Bismarck Road) runs along south border of site.	T.H.&B. north-south rail line bisects site.	None	N/A
LF-23C	0		No utilities cross site (local services excepted).	Highway 20 is located 1.3 km west and 500 m south of site.	T.H.&B. Rail line located 200 m north of site.	None	N/A
LF-24C		0	Hydro tower lines cross northern part of site in east-west direction. Hydro and underground Bell line along Joslin Road.	R.R. #16 located 2.0 km east of site. Joslin Road (local) requires closure of 1.4 km.	T.H.&B. Rail line located 1.5 km east of site.	None	N/A
LF-25C		0	Local Hydro line along 4th Concession East.	Highway 20 flanks south side of site. Fourth Concession East (local) requires closure of 500 m.	T.H.&B. Rail line through north end of site.	None	N/A
LF-26C	0		Hydro line crosses east-west through north part of site.	R.R. #65 (Bismarck Road) runs 1.3 km south of site. R.R. #14 is located 5.0 km east of site.	None	None	N/A
LF-27C	0		Hydro line crosses east-west through south part of site.	R.R. #65 (Bismarck Road) cuts across site requiring closure of 500 m. R.R. #2 is located 3.5 km west of site.	None	None	N/A
LF-28C	0		Hydro line along north border of site.	R.R. #2 runs north-south through site requiring closure of 500 m. R.R. #65 (Bismarck Road) is located 700 m north of site.	None	None	N/A
LF-29C		0	No utilities cross site (local services excepted).	R.R. #27 is located 2.4 km west of site.	None	None	N/A
LF-30C		0	Hydro and underground Bell line along Elcho Road and Heaslip Road.	R.R. #63 flanks south side of site. Elcho Road and Heaslip road require closure of 700 m and 800 m respectively.	None	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-31C	0		Hydro lines cross east-west through south part of the site.	R.R. #14 is located along west border of site. R.R. #65 (Bismarck Road) is located 1.8 km south of site.	None	None	N/A
LF-32C	0		Hydro lines cross east-west through central and southern areas of the site.	R.R. #14 is located along east border of site. R.R. #65 (Bismarck Road) is located 1.3 km south of site.	None	None	N/A
EAST LANDFILL OR INTEGRATED							
LF-1E		0	Local Hydro line along Morris Road (north-south) and along Young Road (east-west). Bell line diagonally across south part of site below ground. Local Bell lines along Morris Road (north-south) and along Young Road (east-west) underground.	Two local road closures needed. Morris Road between Schisler Road and Carl Road; Young Road between Crowland Road and ConRail line. Access to QEW; east along Carl Road to R.R. #98 to R.R. #47 to QEW or Schisler Road (R.R. #27) south side of site to R.R. #98.	ConRail track flanks west side of site.	None	N/A
LF-2E		0	Hydro transmission line runs near west and north part of site. Another line along abandoned rail bed on south side.	Highway 140 flanks east side and R.R. #23 flanks south side. Site access is about 6.5 km from end of future Highway 406 intersection with R.R. #27.	ConRail track flanks north side of site. CNR flanks southeast corner of site.	None	N/A
LF-3E		0	Bell line underground across southeast corner of site. High pressure oil pipeline across northeast part of site.	R.R. #47 flanks north side and R.R. #98 flanks east side of site. Access to QEW from R.R. #47.	ConRail track adjoins northwest corner of site.	None	N/A
LF-4E		0	Local Hydro line along Misener Road through centre of site. Local Bell line along Misener Road through centre of site.	Misener Road (local) through site must be closed; it is not a through road. R.R. #98 flanks east side. Access to QEW follows R.R. #98 to R.R. #47 to QEW.	ConRail track is 1.3 km to the west of the site.	None	N/A
LF-5E	0		No utilities cross site.	R.R. #98 runs through east edge of site; road closure required. QEW access would follow R.R. #98 north to R.R. #47 to QEW.	ConRail line approximately 1.5 km west and another line 1.5 km south of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-6E		0	Provincial Gas pipeline runs through site. Local Hydro and Bell underground lines along roads.	Roads crossing site: - Highway 140 - Strawn Road - Reakar Road - Rusholme Road - Moore Road Welland Canal flanks west side.	CNR and ConRail lines cross site.	None	N/A
LF-7E		0	Hydro tower line crosses east and west parts of site. Regional sewage line crosses through central site. Gas line along west edge of site.	R.R. #68 flanks west side of site. Site crossed by Highway 58A.	CNR/ConRail line (three- track) passes through site. CNR line (single-track) passes through site.	None	N/A
LF-8E		0	Provincial gas pipelines along Highway 58 and local lines on Kleiner Street, Pietz Road, and Colborne Street. Local Hydro and underground Bell lines along Pietz Road and Colborne Street. Major Hydro transmission and Bell lines through site.	Roads crossing site: - Highway 58 - Highway 58A - Pietz Road - Kleiner Road - Colborne Road Abandoned Welland Canal flanks west side of site.	CN/ConRail line (three-track) passes through site.	None	N/A
LF-9E		0	Interprovincial high pressure oil pipeline crosses site. Local gas line along Stanley Avenue. Local Hydro and underground Bell lines along Marshall Road, Beck Road and Stanley Avenue.	Roads crossing site: - QEW - Marshall Road - Beck Road - Stanley Avenue	None	None	N/A
LF-10E		0	Interprovincial high pressure oil pipeline crosses north and east part of site. The Hydro transmission lines run through site. Hydro line along Matthew Road and its northern right-of-way extensions. Possibly gas line along Bigger Road. Bell lines run north-south through central site.	Roads crossing site: - Bigger Road (R.R. #47) - Moyer Road (R.R. #84) - McKenney Road - Morris Road - Carl Road - Matthew Road	ConRail line located east of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
LF-11E	0		No utilities cross site.	R.R. #29 crosses northern part of site. R.R. #36 east of site boundary. Access to QEW follows R.R. #36 north to R.R. #63 east to Highway 406.	ConRail line located 200 m south of site.	None	N/A
LF-12E		0	Local Hydro and underground Bell lines along Beck Road, Will O'Dell Road, Schister Road, Sauer Road and Bossert Road. Local gas line along Kosbel Road.	QEW located 600 m north of site. Local roads crossing site: - Beck Road - Will O'Dell Road - Schister Road - Gonder Road - Lemon Road - Kosbel Road - Bossert Road - Sayer Road	None	None	N/A
NORTH PARTIALLY INTEGRATED							
PI-1AI		0	Underground Hydro and water main in southern part of site.	Highway 7 is 800 m south and R.R. #7 (Airport Road) is the eastern site boundary.	None	No smoke stack height restriction with respect to Pearson International Airport; however, Transport Canada concerned with possible visibility or air quality conflict.	15.0 km to LF-2N
PI-2AI		0	None	No road closures. R.R. #7 (Airport Road) is 500 m west and Highway 7 is 3 km south. R.R. #10 Side Road flanks north side.	None	No smoke stack height restriction with respect to Pearson International Airport; however Transport Canada concerned with possible visibility or air quality conflict.	16.6 km to LF-2N
PI-3AI		0	Underground local Bell line along west side of Torbram Road.	R.R. #14 forms part of the sites northern boundary and Highway 7 is approximately 6 km south. Torbram Road (local) runs through site.	None	None	19.7 km to LF-2N
PI-1N		0	High pressure oil pipeline runs through site in an east-west direction.	R.R. #6 is located 600 m north. Access to Highway 401 or QEW would follow R.R. #6 to Highway 25 than 10 km north to Highway 401 or 12 km south to QEW.	CNR through edge of site.	None	N/A
PI-2N		0	High pressure oil pipeline runs through site in an E-W direction.	No road closures. Highway 25 is 300 m to the east and R.R. #6 is 500 m to the north. Access to QEW and 401 would follow Highway 25: 12 km south to QEW, and 10 km north to 401.	CNR line approximately 1 km to the west running parallel to west side.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-3N		0	Local Hydro and Bell above ground along Highway 10 (east side of site).	Highway 10 flanks east side of site. R.R. #25 (Derry Road) flanks north side. Site is 500 m north of Highway 401.	None	Site within runway zoning control limits and smoke stack height cannot exceed 83.2 m (273 ft.) limit.	N/A
PI-4N		0	Local Hydro and Bell above ground along Highway 10 (west side of site). Major Hydro transmission line along north edge of site.	Highway 401 is 1 km south and Highway 10 flanks west side of site. R.R. #25 (Derry Road) flanks north side.	None	Pearson International is 5 km east and runway zoning control limits smoke stack height to somewhat higher than 45 m (150 ft.)	N/A
PI-5N		0	Local Hydro on east side of Tomkin Road with side branch to transformer. Water, gas and Bell underground along Tomkin Road. Major Hydro transmission line along south edge of site.	R.R. #5 (Derry Road) borders the north side of site. Highway 401 is 2 km south. First Line Road (local) and Highway 410 cross site.	None	Pearson International is 4 km east with main east-west runway 2 km to the east of Tomkin Road. Maximum smoke stack height would be 45 m (150 ft.) or less.	N/A
PI-6N		0	Hydro transmission lines along north border.	R.R. #25 (Derry Road) flanks south side of site, Highway 10 is 700 m west and Highway 410 700 m east. Highway 401 is 3 km south.	None	Pearson International is 5 km southeast of site with main east-west runway 3.5 km east. Runway zoning control would limit smoke stack height to somewhat higher than 45 m (150 ft.).	N/A
PI-7N	0		Oil pipeline east-west across site south of Britannia Road. Bell line along Highway 25 in northerly section of site. Gas pipeline north-south through site.	Highway 25 bisects site north-south and provides access to Highway 401 and QEW. R.R. #6 (Britannia Road) intersects Highway 25 at approximately mid-point of site. Requires closure of 2.6 km of Highway 25 and 1.0 km of R.R. #6 (Britannia Road).	CNR line 500 m west of west border of site.	None	N/A
PI-8N	0		Bell line along west side of Third Line Road. Gas line runs east-west just south of north border of site and along Third Line Road in northerly section of site.	Highway 25 flanks west side of site and provides access to Highway 401 and QEW. R.R. #6 (Britannia Road) runs along southern border of site.	None	None	N/A
PI-9N	0		No utilities cross site (local services excepted).	Highway 401 cuts across north border of site. Highway 10 is 500 m to the east. R.R. #3 (Britannia Road) cuts through the southern portion of site requiring closure of 1.0 km.	None	Pearson International Airport located 6 km to the east. Runway zoning control would limit smoke stack height to approximately 68.3 m (224 ft.).	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-10N		0	Oil pipeline along north edge of site.	R.R. #6 (Britannia Road) is 600 m north. Highway 25 is to the west and provides access to Highway 401 or QEW.	None	None	N/A
PI-11N		0	Oil pipeline just north of site.	R.R. #6 (Britannia Road) is 600 m north. Highway 25 is to the west and provides access to Highway 401 and QEW.	None	None	N/A
PI-12N		0	No utilities cross site (except local services)	R.R. #6 (Britannia Road) is 1.5 km north. Highway 25 is to the west and provides access to Highway 401 and QEW.	None	None	N/A
PI-13N		0	Oil pipeline cuts through site from west to east.	R.R. #6 (Britannia Road) is 300 m north. Highway 25 is to the west and provides access to Highway 401 and QEW.	None	None	N/A
PI-14N		0	No utilities cross site (local services excepted).	R.R. #6 (Britannia Road) is 1.2 km north. Highway 25 is to the west and provides access to Highway 401 and QEW. Fifth Line Road (local) crosses west portion of site.	None	None	N/A
PI-15N		0	Gas pipeline outside north boundary of site. Local Hydro and Bell lines along east boundary.	R.R. #25 (Derry Road) is 600 m north and R.R. #6 (Britannia Road) is 2.4 km south. Both provide access to Highway 25 to the west then to Highway 401 to the north or QEW to the south.	None	None	N/A
WEST PARTIALLY INTEGRATED							
PI-1W	0		Gas pipeline along western flank of site on Highway 56.	Highway 56 runs through west side of site. Access to QEW north along Highway 56 to Highway 20 to QEW.	CN Rail line 2 km southwest of site.	None	N/A
PI-2W		0	Hydro transmission lines run along south site boundary.	R.R. #222 flanks west side of site. Highway 53 to the north. Access to Highway 403 nearby.	None	Hamilton Civic Airport is 7 km away and outside 4 km control area. Runway zoning control applies and clearance elevation for smokestack is 68.6 m (225 ft.).	N/A
PI-3W	0		No utilities cross site (local services excepted).	Highway 54 is 2 km south of site and R.R. #222 is 4.5 km east. One road closure (local) through centre of site is indicated.	CN Rail line approximately 500 m south of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM P1 TO LANDFILL SITE AREA
P1-4W	0		Hydro line through western part of site. Oil pipeline runs through southeast portion of site.	R.R. #53 flanks east side of site. R.R. #16 is approximately 1 km west. Highway 53 is 2.5 km north. Three local road closures required.	None	Site within 4 km range of Hamilton Civic and smoke stack height therefore limited to 45 m (150 ft.) or less.	N/A
P1-5W	0		No utilities cross site (local services excepted).	R.R. #22 is 900 m west of site. Site approximately 10 km south of Highway 403.	CN Rail 1 km south of site.	None	N/A
P1-6W	0		No utilities cross site (local services excepted).	Highway 56 is 1.5 km west of site. Two local road closures required.	None	None	N/A
CENTRAL PARTIALLY INTEGRATED							
P1-1C		0	Hydro transmission line forms northern boundary of site. A local Hydro line runs east-west at the south end of the site.	R.R. #14 is 400 m west running north-south. It connects with Highway 20 1 km south and QEW 10 km north.	T.H.&B. Rail line runs 900 m south of site.	None	N/A
P1-2C		0	Hydro transmission line forms part of north site boundary. Local gas pipeline runs along part of south boundary.	R.R. #65 (Bismarck Road) flanks part of north site boundary. Access to QEW is along R.R. #6, Highway 20 and R.R. #12 for 73 km.	None	None	N/A
P1-3C	0		No utilities cross site (local services excepted).	Highway 57 is located 700 m north of site. R.R. #24 is located 500 m east of site.	ConRail line runs east-west through centre of site.	None	N/A
P1-4C	0		Hydro line passes east-west through north part of site. Second hydro line crosses east-west through south part of site.	R.R. #65 runs east-west through the north section of the site requiring closure of 600 m. R.R. #2 is located 3.2 km west of site.	None	None	N/A
P1-5C	0		Hydro line runs through south part of site.	R.R. #2 is located 300 m west of the site. R.R. #65 is located 1.2 km north of the site.	None	None	N/A
P1-6C	0		Hydro line runs through site.	R.R. #65 is located 1.6 km south of the site. R.R. #14 is located 2.5 km east of the site.	None	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-7C	0		Hydro line crosses east-west through north part of site.	R.R. #65 runs east-west through centre of the site requiring closure of 1.6 km. R.R. #14 is located 800 m east of the site.	None	None	N/A
PI-8C	0		No utilities cross site (local services excepted).	R.R. #65 is located 100 m north of the site. R.R. #16 is located 500 m east of the site.	None	None	N/A
PI-9C	0		Hydro line is north of site.	R.R. #16 runs north-south bisecting the site requiring closure of 1.0 km. Highway 20 is located 3.5 km north of the site.	T.H.&B. Rail line runs north-south through site.	None	N/A
PI-10C	0		No utilities cross site (local services excepted).	Highway 20 is located 1.3 km west of site and 800 m south of site.	T.H.&B. Rail line cuts east-west across edge of site.	None	N/A
PI-11C		0	Hydro and underground Bell line along Highway 20.	Highway 20 runs east-west through site requiring closure of 500 m.	T.H.&B. Rail line located 1.9 km north of site.	None	N/A
PI-12C	0		No utilities cross site (local services excepted). Bell lines located 300 m south of site.	Highway 20 is located 100 m north of site. R.R. #24 is located 3.2 km east of site.	T.H.&B. Rail line runs east-west 800 m to north of site.	None	N/A
PI-13C	0		No utilities cross site (local services excepted).	R.R. #24 forms part of the east border of the site. Highway 20 is located 3.0 km north of the site.	T.H.&B. Rail line crosses east-west through centre of site.	None	N/A
PI-14C	0		No utilities cross site (local services excepted).	Highway 3 is located 1.5 km north and 2.0 km east of the site.	None	None	N/A
PI-15C		0	No utilities cross site (local services excepted).	Highway 3 forms part of the east border of the site. R.R. #3 is located 1.1 km south of the site. Some local road closures required.	2 km north of CNR line	None	N/A
PI-16C	0		No utilities cross site (local services excepted).	R.R. #27 is located 100 m north of the site. R.R. #23 is located 200 m south of the site.	ConRail line crosses east-west through north section of site. CNR line crosses east-west through south section of site.	Welland-Port Colborne Airport located 700 m north of site. This location for a smoke stack could conflict with air navigation.	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
	1:90 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM P1 TO LANDFILL SITE AREA
P1-17C	0		No utilities cross site (local services excepted).	R.R. # 27 forms part of the north border of the site. R.R. #23 is located 700 m south of the site.	ConRail line splits west of site with two lines crossing east-west through north part of site. CNR line crosses east-west through south part of site.	Welland-Port Colborne Airport located 2.5 km northwest of site. This location for a smoke stack could conflict with air navigation.	N/A
P1-18C	0		Hydro line runs east-west along north edge of site.	R.R. #2 runs north-south through the site requiring closure of 300 m. R.R. #65 is located 800 m north of the site.	None	None	N/A
P1-19C		0	Hydro line runs north and south of site.	R.R. #65 is located 600 m north of the site. R.R. #2 is located 1.8 km west of the site. Some local road closures required.	None	None	N/A
P1-20C	0		Hydro line runs east-west along north boundary of site.	R.R. #65 is located 1.3 km south of the site. R.R. #14 is located 5.0 km east of the site.	None	None	N/A
P1-21C		0	Hydro tower lines cross northern part of site in east-west direction. Hydro and underground Bell line along Joslin Road.	R.R. #16 is located 2.0 km east of the site. Joslin Road (local) requires closure of 1.4 km.	T.H.&B. Rail line located 1.5 km east of site.	None	N/A
P1-22C		0	Underground Bell line crosses through site. Hydro line along Tober Road.	R.R. #16 crosses east side of site. R.R. #14 runs 700 m to north of site. Site located 3 km west of Highway 20. Tober Road requires closure of 1.3 km.	T.H.&B. Rail line located on east edge of site.	None	N/A
P1-23C	0		No utilities cross site (local services excepted).	Highway 20 runs east-west through the south part of site. R.R. #24 is located 3.8 km east of the site.	T.H.&B. Rail line runs through site east to west.	None	N/A
P1-24C	0		No utilities cross site (local services excepted).	R.R. #20 is located 2.3 km west of the site. Highway 3 is located 3.0 km south of the site.	ConRail line runs east-west and 1.0 km south of site.	None	N/A
P1-25C		0	Hydro and underground Bell line along R.R. #27.	Highway 20 located 2.4 km north of site. R.R. #27 requires closure of 700 m.	None	None	N/A
P1-26C		0	Hydro transmission line bisects site in a north-south direction. A local Hydro line along Krick Road in a north-south direction would require relocation.	Krick Road (local) north of Zumstein for 900 m must be closed, plus Private Drive located on site. R.R. #63 flanks south side and R.R. #16 flanks west side. R.R. #16 provides access to Highway 20 11 km north.	T.H.&B. rail line located 300 m west and runs parallel to west site boundary.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING^{3}		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
EAST PARTIALLY INTEGRATED							
PI-1E		0	No utilities cross site (local utilities excepted).	R.R. #102 is located 800 m west and provides access to R.R. #47 or #49 to QEW.	ConRail tracks border northwest side of site.	None	11.7 km to LF-1E 9.2 km to LF-3E
PI-2E		0	No utilities cross site (local utilities excepted).	R.R. #102 is located 800 m west and provides access to R.R. #47 to QEW.	ConRail tracks flank southeast side of site.	None	10.7 km to LF-1E 8.2 km to LF-3E
PI-3E		0	No utilities cross site (local utilities excepted).	R.R. #98 flanks east side of site. R.R. #63 passes between north and south portions of site. Site access is approximately 3 km from QEW along R.R. #47 and R.R. #98.	None	None	N/A
PI-4E		0	No utilities cross site, but local Hydro lines run north-south along west side of site.	R.R. #63 flanks south side of site. Access to QEW is available from R.R. #63 to R.R. #98 then north to R.R. #49 or south to R.R. #47.	None	None	7.2 km to LF-1E 7.4 km to LF-3E
PI-5E		0	Site area bisected by Hydro corridor. Another Hydro line connects to central line from northeast. High pressure petroleum pipeline crosses diagonally from northwest to southeast.	R.R. #63 flanks south side with R.R. #84 450 m west and R.R. #70 350 m east. Route to QEW is R.R. #63 to south then R.R. #84 to R.R. #47 to QEW. Approximately 7.3 km.	CNR track flanks north side of site.	None	4.3 km to LF-1E 4.5 km to LF-3E

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-6E		0	Bell line underground across southeast corner of site. High pressure oil pipeline across central part of site.	R.R. #47 flanks north side and R.R. #98 flanks east side of site. Access to QEW from R.R. #47.	ConRail track immediately at northwest corner of site.	None	N/A
PI-7E		0	No utilities cross site. Hydro line runs north of site.	A local road through middle of site must be closed. This route could be used as an access point to site if upgraded. R.R. #47 from QEW to first local road west of Morris Road will provide access to site.	ConRail track flanks east side of site.	None	N/A
PI-8E		0	Underground Bell and Hydro line along Matthew Road. Hydro transmission line southeast edge of site.	Matthew Road (local) through site must be closed. R.R. #84 flanks west side of site. QEW/R.R. #47 Interchange approximately 5.3 km from site.	Abandoned track flanks southeast side of site. A single track runs north-south about 400 m east of site.	None	N/A
PI-9E		0	Hydro, gas and telephone lines along Ort Road through middle of site in north-south direction.	Ort Road (local) through site must be closed. QEW is accessible via R.R. #116 which connects to Sauer Road (the south boundary).	ConRail track 4 km to south is closest rail line.	None	N/A
PI-10E		0	Local Hydro, gas and telephone lines along Newgate Road.	R.R. #25 flanks south side, R.R. #116 flanks east side. Site is 1.7 km south of QEW/R.R. #116 Interchange.	ConRail track 1.6 km south, is closest rail line.	None	N/A
PI-11E		0	Local Bell line underground approximately 450 m south of R.R. #25. Hydro line (local)bisects site along College Road.	College Road (local) through middle of site in east-west direction. R.R. #25 runs through the north side of the site and R.R. #116 flanks the west. Access from QEW/R.R. #116 Interchange, which is 3 km north of site on R.R. #116.	ConRail track approximately 100 m south of site.	None	N/A
PI-12E		0	Local Hydro and Bell lines along Eagle Street through site in east-west direction.	Local Roads, Sider Road from ConRail track on south to College Road on north, and Eagle Street from Beaver Creek on east to Black Creek Drive on west must be closed. QEW access from R.R. 21 which runs parallel to south boundary of site.	ConRail track flanks south side of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

SITES	MAP SCALE FOR SCREENING[3] 1:50 000	MAP SCALE FOR SCREENING[3] 1:10 000	SUITABILITY AND SYSTEM SCREEN FACTORS: TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	SUITABILITY AND SYSTEM SCREEN FACTORS: AIRPORT FACILITY CONFLICT WITH SITE AREA	SYSTEM SCREEN FACTOR[1,2]: TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-13E		0	Local Hydro and Bell along Eagle (east-west) and along Ridgemount (north-south).	Local roads, Ridgmount Road between ConRail track and QEW, and Eagle Street between Beaver Creek and QEW must be closed. QEW flanks northwest side. QEW access from R.R. #21 which runs parallel to southern boundary of site.	ConRail track flanks south side of site.	None	N/A
PI-14E		0	Local Hydro line on Shisler Road through middle of site.	Shisler Road (local) north of R.R. #21 through middle of site in north-south direction must be closed. Access to QEW is 1.7 km east along R.R. #21.	CNR line flanks north side of site.	None	N/A
PI-15E		0	Local Bell line and Hydro along Acadia Street above ground.	Sider Road from R.R. #21 on the south and CNR tracks on the north, and Acadia Street east of Sider must be closed. Access to site from R.R. #21/QEW. R.R. #116 is 1.9 km east of site.	CNR track flanks south side of site. ConRail flanks north side of site.	None	N/A
PI-16E		0	Local Bell and Hydro transmission lines along Side Road in east part of site. Hydro line along Winger Road in west part.	Local roads Winger Road and Sider Road between R.R. #21 and CNR line on north through site must be closed. R.R. #21 flanks south side of site and provides access to QEW. R.R. #116 is 1.9 km west of site.	CNR flanks north side of site.	None	N/A
PI-17E		0	Gas pipeline and local telephone along Strawn Road bisecting site in a north-south direction. Local Hydro line for a short distance along Strawn Road.	Strawn Road (local) through site must be close between Ridge Road and ConRail track. Highway 140 is to the west and R.R. #84 is to the east. Access to Highway 406 is Highway 140 to R.R. #27 to Highway 406, approximately 3.8 km. Assumes Highway 406 extension to R.R. #27.	ConRail track flanks south side of site and CNR track flanks west side.	None	N/A
PI-18E		0	Local Hydro line on west side of site.	Highway 140 flanks west side of site. Access to Highway 406 would follow Highway 140 to R.R. #27 to Highway 406, approximately 3.8 km. Assumes Highway 406 extension to R.R. #27.	ConRail flanks south side and CNR flanks east side of site.	None	N/A
PI-19E		0	Hydro line near east side of site along road.	Local road on east side of site must be closed. Highway 140 flanks west side of site. Access to Highway 406 would follow Highway 140 to R.R. #27 to Highway 406 approximately 6.5 km. Assumes Highway 406 extended to R.R. 27.	CNR runs through eastern portion of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING^3		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR^{1,2}
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-20E		0	No utilities crossing site.	R.R. #23 flanks north side. Highway 58 is just to the east. Access to Highway 406 is approximately 12.7 km north, much of which is through urban areas of Welland.	None	None	N/A
PI-21E		0	Hydro transmission line runs near west and north parts of site. Another line runs along abandoned rail bed on south side.	Highway 140 flanks east side and R.R. #23 flanks south side. Site access is about 6.5 km from end of Highway 406 (future) along R.R. #27 to Highway 140.	ConRail track flanks north side of site. CNR flanks southeast corner of site.	None	N/A
PI-22E	0		No utilities cross site (local utilities excepted).	Highway 58 flanks west side; R.R. #80 flanks east side. Site is 3.5 km north of Highway 3.	CNR track 800 m north.	None	N/A
PI-23E	0		No utilities cross site (local utilities excepted).	South portion bisected by QEW. R.R. #116 is 500 m west of site.	None	None	N/A
PI-24E	0		No utilities cross site (local utilities excepted).	QEW borders south side. R.R. #116 bisects site and closure would be required.	None	None	N/A
PI-25E	0		Oil pipeline bisects site in a NW-SE direction.	QEW runs along south side. R.R. #116 is 500 m east of site.	None	None	N/A
PI-26E		0	Local Hydro line along Morris Road (north-south) and along Young Road (east-west). Bell line diagonally across south part of site below ground. Local Bell lines along Morris Road (north-south) and along Yoump Road (east-west) underground.	Two local road closures needed. Morris Road between Schislor Road and Carl Road; Young Road between Crowland Road and ConRail line. R.R. #27 crosses south part of site.	ConRail track flanks west side of site.	None	N/A
PI-27E		0	Gas pipeline at the southwest corner of site. Hydro line bisects site in a southwest to northeast direction.	R.R. #98 crosses site. R.R. #47 flanks south side. QEW flanks east side. Welland River 200 m north of site.	ConRail track bisects site in a SW-NE direction.	None	1.2 km to LF-1E 0.1 km to LF-3E
PI-28E	0		Gas pipeline along south edge of site. Bell lines cross site in east.	Welland River flanks north side.	ConRail track north of site.	None	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-29E	0		Oil pipeline bisects site in a NW-SE direction.	QEW bisects site. R.R. #47 is approximately 500 m north of site.	None	None	N/A
PI-30E		0	Interprovincial high pressure oil pipeline crosses north and east part of site. Hydro transmission lines just west of Moyer road. Hydro line along Matthew Road and its northern right-of-way extension. Provincial gas pipeline along Grassy Brock Road, Darby Road and Bigger Road.	Roads crossing site: - Bigger Road (R.R. #47) - Moyer Road (R.R. #84) - McKenney Road - Morris Road - Carl Road - Matthew Road - Grassy Brock Road - Darby Road	ConRail line located on south edge of site.	None	N/A
PI-31E		0	Underground Bell line crosses site. Local Hydro lines along railway line, Netherby Road, House Road and part of College Road.	R.R. #116 flanks east side of site. Other Roads crossing site: - R.R. #25 - College Road - Ott Road - House Road - Newgate Road	ConRail line (single track) passes along south edge of site. CNR line located south of site.	None	N/A
PI-32E	0		Bell lines cross site in southern portion of site.	R.R. #98 is approximately 300 m west of western edge of site. R.R. #116 is 3 km east. R.R. #25 crosses site in southern part.	ConRail track 600 m from southeast corner of site.	None	N/A
PI-33E	0		No utilities cross site (local utilities excepted).	R.R. #98 crosses side of site. R.R. #27 is 1 km north.	ConRail track 1 km west of west site boundary and 1.5 km from southern end of site.	Close to Welland Airport	N/A
PI-34E		0	Provincial gas pipelines through north end of site. Two Hydro lines run north-south through site. Local Hydro and Bell lines along Pletz Road and Colborne Street. Section of water main in north end of site.	Roads crossing site: - Highway 58 - Highway 58A - R.R. #68 - Pletz Road - Kleiner Street - Colborne Road - Shaw Street	ConRail line (3 track) passes through site. CNR line (single track) passes through site.	None	N/A
PI-35E	0		No utilities cross site (local utilities excepted).	R.R. #29 is 11 km north and R.R. #27 is 500 m south of site. R.R. #529 is 1 km west.	ConRail track 1 km south of site.	Close to Welland - Port Colborne Airport.	N/A

TABLE E-2: SITE AREA SCREENING - TRANSPORTATION

	MAP SCALE FOR SCREENING[3]		SUITABILITY AND SYSTEM SCREEN FACTORS				SYSTEM SCREEN FACTOR[1,2]
SITES	1:50 000	1:10 000	TRANSMISSION LINES (Hydro, Bell, etc.) THROUGH OR IN PROXIMITY TO SITE AREA	PROVINCIAL HIGHWAYS AND REGIONAL ARTERIAL ROADS THROUGH OR IN PROXIMITY TO SITE AREA	RAIL LINE THROUGH OR IN PROXIMITY TO SITE AREA	AIRPORT FACILITY CONFLICT WITH SITE AREA	TRAVEL DISTANCE FROM PI TO LANDFILL SITE AREA
PI-36E	0		No utilities cross site (local utilities excepted).	R.R. #29 bisects site east-west direction. R.R. #36 is near east edge of site.	ConRail track 2 km south of site.	None	N/A
PI-37E		0	Local Hydro and underground Bell lines along Beck Road, Will O'Dell Road, Schisler Road, Sauer Road, and Bossert Road. Local gas line along Koabel Road.	QEW located 600 m north of site. Roads (local) crossing site: - Bech Road - Will O'Dell Road - Schisler Road - Gonder Road - Lemon Road - Koabel Road - Bossert Road - Sauer Road	None	None	N/A

GENERAL NOTES:

1. Two additional system screen factors were developed based upon the 17 cluster centroids, and are displayed in Appendix Table E-1.
2. The system screen factor, distance from PI to landfill site areas, applies only to PI site areas which survived the Suitability and Compatibility Screens.
3. Scale of screening is indicated for each of the 152 site areas. This is the scale at which it was screened out or retained by the site selection consultant.

APPENDIX F
FACTOR SHEETS FOR IDENTIFICATION OF CANDIDATE SITES
(INITIAL COMPARATIVE EVALUATION)

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING:	**FACTOR:**
TRANSPORTATION	PROXIMITY TO RAIL ACCESS

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR: Availability of rail access to integrated treatment sites or to non-integrated physical chemical/incinerator sites may be a positive locational factor for the haulage of untreated special wastes, and/or the haulage of process reagents or additives for large bulk shipments.

RATIONALE/SIGNIFICANCE: If consolidation/transfer sites are used to consolidate special wastes in spatially separated areas, e.g. Thunder Bay, Ottawa, etc., the rail transport mode might be a desirable method for shipment of the wastes to OWMC treatment facilities.

Depending on the treatment process selected, there could be the need for bulk handling of cement and fly ash additives in the solidification process. If bulk storage facilities are included on the facility site for these materials, the rail mode may be the preferred mode to receive these shipments.

Process reagents (mainly lime) will also be required at the physical chemical treatment facility. If bulk storage is provided on site, the rail mode may be the most suitable means of conveyance.

SOURCES OF INFORMATION: The information on rail lines or abandoned rail lines is recorded on OWMC base mapping and overlays thereto at a scale of 1:50 000. More detailed information is provided on the 1:10 000 scale mapping used for site reconnaissance. During site screening reconnaissance, field and office data forms also recorded rail availability and constraints to spur line development.

INTERPRETATION/METHODOLOGY: From the source information it was possible to discern which sites were located within sufficient proximity to rail lines and were feasible sites to consider the construction of an industrial spur line connection to the railway mainline or branch line. Generally, a site within 2 to 3 km of a rail line was considered to be accessible to rail service. A possible constraint to the provision of a spur line connection involves the need to cross arterial roadways. If an at-grade rail crossing is permitted, costs would be modest; however, if the crossing involved a heavily travelled arterial roadway and relatively frequent daily movements of rail service is required, a grade separation might be warranted. This could result in high construction costs to provide rail service.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROXIMITY TO RAIL ACCESS

CRITERIA/INDICATORS: Proximity of rail lines to potential OWMC facility sites is the indicator of rail service possibilities. Information recorded includes the straight line distance between the rail line and the potential site. In all cases and wherever possible, the length of spur line required, attempts to avoid or minimize roadway crossings and in particular, avoids crossings of arterial type roads. Arterial road crossings could not be avoided in certain instances.

COMMENTS/ASSUMPTIONS/LIMITATIONS: No definite plan has been developed for the transport of special wastes to OWMC treatment sites. The use of rail service for the bulk hauling of process reagents and additives assuming a 150,000 tonne/annum waste stream could involve a requirement for reagents and additives within the range of 12 500 to 35 000 tonnes/annum. If OWMC facilities provide for bulk storage of these materials on a proven cost effective basis, rail transport in bulk shipments could be viable.

Until facility related decisions are made, no attempt has been made to determine the cost of providing rail service to the sites where rail does not adjoin a site.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROXIMITY TO ARTERIAL ROADS

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: Preliminary access routes will be via existing arterial roads. Access to individual facility sites (including travel between PI and Landfill sites) will require access over other existing roads, the construction of a new roadway connection from the arterial system to the site boundary or direct access from the arterial road.

RATIONAL/SIGNIFICANCE: Where facility sites flank an arterial road it is probable that direct access can be provided directly to the site assuming that road geometrics do not preclude the acceptability of a site entrance. However, in instances where the site boundaries are remote from an arterial roadway, provision must be made for improvements of other existing collector or local service roads or the construction of a new roadway from the arterial system to the site boundary.

SOURCES OF INFORMATION: Three sources of information exist by which a preliminary determination of road access availability can be made:

- OWMC Base Mapping at 1:50 000 scale

- Municipal and Township Roads Needs Studies

- Field Reconnaissance of Sites

Field reconnaissance is proposed only for facility site locations wherein available maps and plans provide an insufficient level of detail to discern the requirement for improved access, or where road geometry may limit access potential from an existing collector or a local road.

INTERPRETATION/METHODOLOGY: Using secondary sources or field reconnaissance where required, the distance from a facility site boundary to the identified arterial road system would be determined. The access route selected would be the one that provides minimum travel distance, although the avoidance of hazardous locations, e.g. at-grade rail crossings on local roads, is a controlling factor that would be more important than travel path length. Where it is not practical to avoid an at-grade rail crossing, this situation would be "flagged" to identify the safety related concern.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROXIMITY TO ARTERIAL ROADS

CRITERIA INDICATORS: Three indicators will be used to reflect capital improvement costs required to access each potential site (include access from PI to Landfill). The unit of measurement will be kilometres, to be developed as follows:

Rule #1: Sites adjoining existing arterial roadways will have a "0" kilometre value as these may be accessed directly from the arterial.

Rule #2: Sites adjoining existing collector or local roadways will have a distance measurement from the nearest boundary of the site along the collector or local roadway back to the closest arterial roadway.

Rule #3: a) Arterial Roadway along New Road
b) Arterial Roadway along Existing Collector or Local Roadway and along new roadway

The order-of-magnitude construction costs for the new or improved roadway requirements to facilitate entry to the site boundary is:

- upgrade existing local or collector roadway to Class A type - $150/m + eng.

- construct new roadway from site to arterial or collector/local roadway to Class A type: $180/m exclusive of property, grading and engineering.

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OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING:	**FACTOR:**
TRANSPORTATION	SITE PROXIMITY TO FREEWAYS

FACILITY COMPONENTS AFFECTED: All integrated sites and Physical/Chemical/ Incinerator sites.

DEFINITION OF FACTOR: The location of OWMC facilities, in reasonably close proximity to freeways, is viewed to be a desirable attribute.

RATIONAL/SIGNIFICANCE: The impact of road transportation to and from OWMC facilities and in relation to local communities and populations, would generally be minimized where sites are close to freeway systems and arterial road interchanges with the freeway.

SOURCES OF INFORMATION: The inputs required for this analysis include:

- identification of the minimum time and/or distance routing from S10.1 Highway Network Build and S10.3 Site Cluster Analysis activities;
- inspection of alternative routing possibilities between the freeway system and identified potential sites;
- inputs from other OWMC consultants dealing with socio-environmental factors, agricultural factors, etc.

INTERPRETATION/METHODOLOGY: Based upon the source information, a preferred access routing was selected from the primary access route (freeway) to the possible site location of an OWMC facility.

As all arriving special wastes are treated at the physical chemical/ incinerator site, the routings selected are either to a non-integrated physical chemcial/incincerator site or the fully integrated landfill/treatment facilities.

CRITERIA/INDICATORS: Distance between the freeway interchange and the site was the indicator used. This was measured in kilometres.

The primary access route from the freeway interchange to the site was either a provincial highway or a regional arterial road. Where alternative routes existed, other factors were considered so that the selected route would produce minimum impact. These other indicators were input as separate factors to initial comparative evaluation.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** SITE PROXIMITY TO FREEWAYS

COMMENTS/ASSUMPTIONS/LIMITATIONS: It was assumed that all provincial roads and regional roads were structurally suitable to accept the transport vehicles that would use OWMC facilities. Further, it has been assumed that the access routes identified are operationally satisfactory in terms of level-of-service, accident frequency, etc. During detailed comparative evaluation, these factors should be reviewed to confirm the suitability of routes and identify road improvement requirements.

This factor should not be weighted too heavily as to a degree it overlaps with tonne-kilometres hauled and the accident frequency index factor. These other factors are superior in that they encompass all transportation haulage routes; whereas the proximity to freeway factor only deals with the final segment of the overall access route system.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	ROAD CLOSURE REQUIREMENTS

FACILITY COMPONENTS AFFECTED: Mainly landfill facilities both fully and partially integrated.

DEFINITION: Fully integrated or partially integrated landfill sites require the assembly of a large block of land generally having a minimum size of 300 acres (120 ha). Due to the state of development within a substantial part of the potential site, few large parcels of land exist that are adequate to satisfy this need. Consequently, to assemble the required land area, the closing of roadways is required in certain instances.

RATIONALE/SIGNIFICANCE: The closing of roads and possible relocation of local utilities could affect local road users unless suitable alternate routes are found and entails a cost for the removal or re-routing of local utilities along these routes (see Factor Sheet for Utility Transmission Installations).

For site selection purposes, the only road closures considered involved local access routes. Sites requiring the closure of provincial or regional arterial routes were discarded as such road closures were considered exclusionary.

SOURCES OF INFORMATION: The information sources used to identify the need for local road closures included:

- OWMC base mapping at scales of 1:50 000 and 1:10 000 showing site locations;
- field reconnaissance and route inspections (carried out in Site Area Screening);
- regional road maps provided by the three major jurisdictions;
- local jurisdiction roads needs studies.

INTERPRETATION/METHODOLOGY: Road closure requirements were identified from the 1:10 000 OWMC site maps prepared for site reconnaissance. In certain instances total closure of existing roads was unnecessary; rather, partial closure was required in certain cases with the construction of cul-de-sacs.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	ROAD CLOSURE REQUIREMENTS

All proposed road closures were field reviewed to determine the physical state and surface conditions of these roads. Alternative routing around each site was examined to determine viability and physical condition of these routes.

Area road maps were also checked to define the consequences of a particular road closure in terms of alternative routings.

CRITERIA/INDICATORS: For purposes of the initial comparative evaluation of sites, information was produced on the probable length of road closure (based on kilometreage) and the surface type and cross section of the route requiring closure.

COMMENTS/ASSUMPTIONS/LIMITATIONS: The proposed closure of any local road would require discussion with the local road authority and the consideration of other improvement needs to make the alternative route(s) acceptable for increased traffic service.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** LOCAL ACCESS ROADS

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR: Local access roads connect the site to arterial roadways in the vicinity of the site. These roadways typically are Class B roads and will need to be upgraded to Class A to support the transport of heavy vehicles to the sites. This upgrade will include railway crossing improvements and roadway structural improvements.

RATIONALE/SIGNIFICANCE: The improvement of local roads will contribute to the building costs of OWMC sites. The length of road and number of railway crossings are good indicators of these costs.

SOURCES OF INFORMATION: Field reconnaissance carried out during Site Screening which recorded length of routings to sites along local roads and the number of railway crossings.

INTERPRETATION/METHODOLOGY: The length of local access road used to reach each site and the number of railway crossings were recorded for comparison.

CRITERIA/INDICATORS: The physical presence of the rail crossings and the length of local access roads were used as indicators of improvement costs.

COMMENTS/LIMITATIONS/ASSUMPTIONS: The indicators of local road improvement costs were used as a comparative factor and the absolute cost of mitigation was not calculated at this stage.

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OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROXIMITY TO TRANSPORT CANADA REGULATED AIRPORTS

FACILITY AFFEFTED: All to varying degrees (see Site Area Screening, Airports)

DEFINITION OF FACTOR: The Lester B. Pearson International Airport and the Hamilton Civic Airport are the only two Transport Canada controlled airports in the study area.

RATIONAL/SIGNIFICANCE: Transport Canada's zoning regulations for these airports extends past the 4 km circle to include 15 km beyond the ends of runways.

SOURCES OF INFORMATION: Field reconnaissance from Site Area Screening Process and recommendations by Transport Canada staff through meetings and correspondence.

INTERPRETATION/METHODOLOGY: Submit information to Transport Canada on sites near airports for review and recommendations

CRITERIA/INDICATORS: Transport Canada provided information with respect to the maximum height of obstructions at the nearest boundary of a potential site. We were then able to determine the maximum permitted height for an incinerator smokestack by subtracting the height of land elevation at the site from the Transport Canada control surface elevation.

COMMENTS/ASSUMPTIONS/LIMITATIONS: Transport Canada regulation could vary over time and other factors such as smoke plume quality could be applied to reject a possible site

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OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** UTILITY TRANSMISSION INSTALLATIONS

FACILITY COMPONENTS AFFECTED: Mainly landfill facilities both fully and partially integrated.

DEFINITION: Fully integrated or partially integrated landfill sites require the assembly of a large block of land generally having a minimum size of 300 acres (120 ha). Due to the state of development within a substantial part of the potential site, few large parcels of land exist that are adequate to satisfy this need. Consequently, to assemble the required land area, the relocation of utility transmission installations is required in certain instances.

RATIONALE/SIGNIFICANCE: The possible relocation of local Utility Transmission Installations entails a cost for the removal or re-routing utility transmission installations around the site.

SOURCES OF INFORMATION: The information sources used to identify the need for local road closures included:

- OWMC base mapping at scales of 1:50 000 and 1:10 000 showing site locations;
- field reconnaissance and route inspections (carried out in Site Area Screening);
- information gathered from transmission companies in Site Area Screening.

INTERPRETATION/METHODOLOGY: Utility Transmission Installations Re-Routing requirements were identified from the 1:10 000 OWMC site maps prepared for site reconnaissance.

COMMENTS/ASSUMPTIONS/LIMITATIONS: The implications of relocating Utility Transmission Installations will need to be discussed with appropriate authorities.

FEBRUARY 1984

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** TRANSPORTATION COSTS

FACILITY COMPONENTS AFFECTED: All facilities.

DEFINITION OF FACTOR: Same as Site Screening

RATIONALE/SIGNIFICANCE: Same as Site Screening, except the annual tonne kilometres hauled to cluster centroids was transposed to represent the amount hauled to potential sites. In addition it was assumed that the solidification process would use cement as the additive agent. Consequently 7700 tonnes/annum of this product was used in the evaluation.

SOURCES OF INFORMATION:

- Same as Site Screening
- routings from cluster centroids to potential sites.

INTERPRETATION/METHODOLOGY: Manual calculations were undertaken to determine the tonne kilometres of haulage for the cement additive assuming the supply source to be near Ingersol,

Using the resulting tonne-kilometres of total haulage at each of the cluster centroids, the most appropriate centroid was selected in proximity to each of the potential facility sites. Manual calculations were then undertaken to adjust the location of the centroid to that of the potential sites. The resulting tonne-kilometres/annum was then an input to the initial comparative evaluation of sites for ranking between sites.

In dealing with non-integrated sites a variation of the above described methodology was required.

The tonne-kilometre total at a cluster centroid was manually transposed to the physical chemical/incinerator potential sites. The calculated residual product, treated for solidification, was then assumed to be hauled by transport vehicles to the landfill site(s). The tonne-kilometres hauled for this transfer was calculated and summed with that calculated for haulage to the PC/I site.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** TRANSPORTATION COST

CRITERIA/INDICATORS: The indicator used was the total annual tonne kilometres of haulage from all sources ending at the landfill site.

As the observed variation between the alternative sites was in the order of 1% to 45% change in tonne-kilometres of haulage, it is possible to stratify these into a relative ranking system ranging from Good to Poor; alternatively, these may be placed in a rank order by dividing the tonne-kilometres of haulage for each site by the value obtained at the site producing the minimum tonne-kilometre value.

The tonne-kilometre value obtained for each site is a surrogate for transport haulage cost. The rank order calculated is an indicator of the increase in haulage cost and demonstrates the percent increase from the base cost.

COMMENTS/ASSUMPTIONS/LIMITATIONS: In addition to the comments listed in site screening, the following comments apply:

- the need for process reagents was excluded from the tonne-kilometres calculations due to an indefinite location of source site(s). The quantity involved is of the order of 6600 tonnes/annum;

- it was assumed that the minimum quantity requirements for solidification additives using the cement only process. If fly ash was also to be used in addition to cement as a part of the solidification process, there could be a significant increase in the tonne-kilometres of haulage.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** PROBABILITY OF TRANSPORT ACCIDENTS

FACILITY COMPONENTS AFFECTED: All

DEFINITION OF FACTOR: Same as Site Area Screening except applied to routings to sites rather than cluster centroids.

RATIONALE/SIGNIFICANCE: Same as Site Area Screening

SOURCES OF INFORMATION:

- Same as Site Area Screening, plus information on routings to selected sites from cluster centroids.

INTERPRETATION/METHODOLOGY: Same as Site Area Screening except applied to sites rather than cluster centroids. The values obtained were inputs to the comparative evaluation tables of sites.

CRITERIA/INDICATORS: The calculated values of each site reflects the estimated accident frequency on a comparative basis - not on an absolute basis.

To provide a comparison, each site value is divided by the identified minimum site value. The observed range was in the order of 1% to 50% change above the minimum value. For comparative evaluation, the range may be stratified into three levels using the comparative terms Good to Poor. Alternatively, these may simply be identified in a rank order of acceptability.

COMMENTS/ASSUMPTIONS/LIMITATIONS: The surrogate value for accident risk is viewed to produce a value which can be indexed to produce the ranking of sites for purposes of initial comparative evaluation. Again, there are limitations as identified in the factor Transportation Cost.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING: TRANSPORTATION	**FACTOR:** NUMBER OF LEVEL RAILWAY CROSSINGS ON ACCESS ROUTES

FACILITY COMPONENTS AFFECTED: All integrated sites and sites with Physical/ Chemical or incinerator facilities.

DEFINITION OF FACTOR: The number of level railcrossings which a waste carrying vehicle must cross to reach the site from a 400-series highway.

RATIONAL/SIGNIFICANCE: Level railway crossings on access roads present a potential transportation safety hazard. The affect of this hazard can be minimized effectively by providing the railway crossing safety devices as warranted by current guidelines.

This factor was applied to the analysis of access routes to the site.

SOURCES OF INFORMATION: 1:10 000 and 1:50 000 scale OWMC base plans of the site, and and access routes.

INTERPRETATION/METHODOLOGY: The total number of level railway crossings for a particular access route was established from the base plans of the access routes.

CRITERIA/INDICATORS: The number of level rail crossings is the only indicator.

COMMENTS/ASSUMPTIONS/LIMITATIONS: It should be noted that although level rail crossings are potential hazardous locations along an access route, adequate railway safety devices (bells, gates, lights, etc.) will be implemented to safely accommodate the additional traffic if necessary.

OWMC PHASE 3: FACTORS FOR IDENTIFICATION OF CANDIDATE SITES (INITIAL COMPARATIVE EVALUATION)

FACTOR GROUPING:	FACTOR:
TRANSPORTATION	NUMBER OF INTERSECTIONS WHERE A TURN IS REQUIRED

FACILITY COMPONENTS AFFECTED: All integrated sites and sites with Physical/Chemical or incinerator facilities.

DEFINITION OF FACTOR: The number of intersections along the access route, between the 400-series highway and the site, where a waste carrying vehicle will need to turn.

RATIONAL/SIGNIFICANCE: Public intersections along an access route where a waste hauling vehicle must make a turn adds to the potential risk of the access route.

This factor was applied to the comparison of alternative access routes to the potential sites.

SOURCES OF INFORMATION: 1:10 000 and 1:50 000 scale OWMC base plans of site, site activity and access routes.

INTERPRETATION/METHODOLOGY: The total number of intersections along the access route where a turn is required, was extracted from the base plans of the access routes.

CRITERIA/INDICATORS: The number of intersections where a turn is required was the only indicator.

COMMENTS/ASSUMPTIONS/LIMITATIONS: The affects of this factor are mitigatable through adequate use of safety devices at intersections along the access routes.

APPENDIX G

INITIAL COMPARATIVE EVALUATION OF SITE ACCESS ROUTES

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
LF-4N	1. From 401: south on Highway 25; west on Steeles Avenue; south on First Line Road; west on Britannia Road to LF-4N	1.2 8.4	K 0	9.6	37.5
	2. From 401: south on Highway 25; west on Steeles Avenue; south on Tremaine Road to LF-4N	1.2 7.8	K 0	9.0	34.9
	*3. From 401: south on Fourth Line Road; west on Britannia Road to LF-4N	11.2	0	11.2	48.0
	4. From 401: south on Fourth Line Road; East on Derry Road; south on Fifth Line Road; west on Britannia Road to LF-4N	14.0	0	14.0	60.1
	5. From 401: south on Trafalgar Road; west on Britannia Road to LF-4N	15.3	0	15.3	65.6
	6. From 403: north on Winston Churchill Boulevard; west on Britannia Road to LF-4N	18.8	0	18.8	80.7
	7. From QEW: north on Trafalgar Road; west on Britannia Road to LF-4N	21.2	0	21.2	90.9
	*8. From QEW: north on Highway 25 (Bronte Road); west on Britannia Road to LF-4N	11.5 2.8	K 0	14.3	25.8
PI-1N to LF-4N	1. West on Britannia Road to LF-4N	1.0	0	1.0	4.3

TABLE G-1

ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-13N to LF-4N	1. North on Fifth Line Road; west on Britannia Road to LF-4N	7.8	0	7.8	33.5
LF-2N	*1. From 401: north on Highway 10 to LF-2N	1.5	K	1.5	1.8
	*2. From 410: west on Derry Road West to LF-2N	1.2	0	1.2	5.1
PI-1A1 to LF-2N	1. South on Airport Road; west on Derry Road East to LF-2N	15.0	0	15.0	64.4
	*2. South on Airport Road; west on Steeles Avenue; south on Dixie Road; west on Derry Road East to LF-2N	15.0	0	15.0	64.4
PI-13N to LF-2N	1. North on Fifth Line Road; east on Britannia Road; north on Trafalgar Road; east on 401; north on Highway 10 to LF-2N	13.8 1.5 9.0	F K 0	24.3	50.9
	*2. North on Fifth Line Road; west on Britannia Road; north on Fourth Line Road; east on 401; north on Highway 10 to LF-2N	17.9 1.5 7.7	F K 0	27.1	48.4
	3. North on Fifth Line Road; west on Derry Road; north on Fourth Line Road; east on 401; north on Highway 10 to LF-2N	17.9 1.5 7.8	F K 0	27.2	48.9

TABLE G-1

ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-1N to LF-2N	1. East on Britannia Road; north on Trafalgar Road; east on 401, north on Highway 10 to LF-2N	13.8 1.5 12.0	F K 0	27.3	63.8
	*2. East on Britannia Road; north on Fourth Line Road; east on 401; north on Highway 10 to LF-2N	17.9 1.5 8.6	F K 0	28.0	52.3
	3. North on First Line Road; east on Steeles Avenue; north on Highway 25; east on 401; north on Highway 10 to LF-2N	21.7 2.6 6.9	F K 0	31.2	49.2
	4. West on Britannia Road; north on Tremaine Road; east on Steeles Avenue; north on Highway 25; east on 401; north on Highway 10 to LF-2N	21.7 2.6 9.5	F K 0	33.8	60.4
PI-1N	1. From 401: south on Highway 25; west on Steeles Avenue; south on First Line Road to PI-1N	1.2 6.9	K 0	8.1	31.0
	2. From 401: south on Highway 25; west on Steeles Avenue; south on Tremaine Road; east on Britannia Road to PI-1N	1.2 9.5	K 0	10.7	42.2
	*3. From 401: south on Fourth Line Road, west on Britannia Road to PI-1N	8.6	0	8.6	36.9
	4. From 401: south on Trafalgar Road; west on Britannia Road to PI-1N	12.5	0	12.5	53.6

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-1N (cont'd)	5. From 403: north on Winston Churchill Boulevard; west on Britannia Road to PI-1N	16.0	0	16.0	68.6
	6. From QEW: north on Trafalgar Road; west on Britannia Road to PI-1N	18.4	0	18.4	78.9
	*7. From QEW: north on Highway 25 (Bronte Road) to PI-1N	10.4	K	10.4	12.5
PI-13N	*1. From 401: south on Fourth Line Road; east on Britannia Road; south on Fifth Line Road to PI-13N	7.7	0	7.7	33.0
	2. From 401: south on Fourth Line Road; east on Derry Road; south on Fifth Line Road to PI-13N	7.8	0	7.8	33.5
	3. From 401: south on Trafalgar Road; west on Britannia Road; south on Fifth Line Road to PI-13N	9.0	0	9.0	38.6
	4. From 403: north on Winston Churchill Boulevard; west on Britannia Road; south on Fifth Line Road to PI-13N	12.4	0	12.4	53.2
	5. From QEW: north on Trafalgar Road; west on Britannia Road; south on Fifth Line Road to PI-13N	14.9	0	14.9	63.9
	*6. From QEW: north on Highway 25 (Bronte Road); east on Britannia Road; south on Fifth Line Road to PI-13N	11.5 4.9	K 0	16.4	34.8

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-1A1	1. From 401: north on Hurontario Street (Highway 10); east on Derry Road East; north on Airport Road to PI-1A1	2.5 16.5	K 0	19.0	73.8
	*2. From 401: north on Hurontario Street (Highway 10); east on Derry Road East; north on Dixie Road; east on Steeles Avenue; north on Airport Road to PI-1A1	2.5 16.5	K 0	19.0	73.8
	3. From 410: east on Derry Road East; north on Airport Road to PI-1A1	14.5	0	14.5	62.2
	4. From 410: east on Derry Road East; north on Dixie Road; east on Steeles Avenue; north on Airport Road to PI-1A1	14.5	0	14.5	62.2
LF-10W	1. From 403: west on Highway 2; south on Regional Road 222; west on Sawmill Road (local road) to LF-10W	3.1 6.5	K 0	9.6	31.6
PI-2W to LF-10W	1. North on Shaver Road; west on Highway 2/53; south on Regional Road 222; west on Sawmill Road (local road) to LF-10W	2.5 7.5	K 0	10.0	35.2
LF-11W	1. From 403: west on Highway 2; south on Regional Road 222 to LF-11W	3.1 2.5	K 0	5.6	14.4
PI-2W to LF-11W	1. North on Shaver Road; west on Highway 2/53; south on Regional Road 222 to LF-11W	2.5 3.5	K 0	6.0	18.0

TABLE G-1

ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-2W	1. From 403: west on Highway 2; south on Shaver Road (local road) to PI-2W	0.5 1.6	K 0	2.1	7.5
LF-1C	*1. From Control Point 1[3]: east on QEW; south on Regional Road 24 (Victoria Avenue/Vineland Townline Road); east on Regional Road 23 (Forkes Road); north on O'Reilly's Road (local road) to LF-1C	13.7 32.9	F 0	46.6	151.6
	2. From Control Point 2[4]:south on 406 (proposed); east on Regional Road 27 (East Main Street); south on Highway 140; west on Netherby Road (local road); south on Rusholme Road (local) west on Regional Road 525; south on Highway 58; west on Regional Road 23 (Forkes Road); north on O'Reilly's Road (local road) to LF-1C	4.3 5.2 11.1	F K 0	20.6	57.1
	3. From Control Point 2: west on Merritt Road (local road); south on Regional Road 50 (Highway 58); east on Regional Road 527; east on Regional Road 27 (East Main Street); south on Highway 140; west on Netherby Road (local road); south on Rusholme Road (local) west on Regional Road 525; south on Highway 58; west on Regional Road 23 (Forkes Road); north on O'Reilly's Road (local road) to LF-1C	9.6 14.8	K 0	24.4	75.0

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
PI-18E to LF-1C	1. South on Highway 140: west on Netherby Road (local road); south on Rusholme Road (local) west on Regional Road 525; south on Highway 58; west on Regional Road 23 (Forkes Road); north on O'Reilly's Road to LF-1C	2.3 9.8	K 0	12.1	44.8
LF-3C	*1. From Control Point 1: east on QEW; south on Vineland Townline Road (Regional Road 24) west on Highway 20; south on Regional Road 27; west on Elcho Road (local road) to LF-3C	13.7 9.3 22.7	F K 0	45.7	119.0
	2. From Control Point 1: east on QEW; south on Vineland Townline Road (Regional Road 24); west on Canborough Road; north on Regional Road 27; west on Elcho Road (local road) to LF-3C	13.7 31.8	F 0	45.5	146.8
	3. From Control Point 1: east on QEW; south on Regional Road 18 (Beamsville Road) west on Regional Road 69 (Twenty Mile Road); south on Regional Road 569; south on Highway 20; south on Regional Road 27; west on Elcho Road (local road) to LF-3C	7.0 3.3 21.2	F K 0	31.5	100.2
	4. From Control Point 1: east on QEW; south on Regional Road 14; south on Regional Road 714; east on Regional Road 73; south on Regional Road 14; east on Highway 20; south on Regional Road 27; west on Elcho Road (local road) to LF-3C	3.5 8.3 20.6	F K 0	32.4	101.0

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
LF-3C (cont'd)	5. From Control Point 1: east on QEW; south on Regional Road 14; south on Regional Road 714; east on Regional Road 73; south on Regional Road 14; south on Regional Road 16 to LF-3C	3.5 23.7	F O	27.2	104.3
	6. From Control Point 1: south on Regional Road 12; east on Highway 20; Regional Road 27; west on Elcho Road (local road) to LF-3C	12.6 16.0	K O	28.6	83.8
	7. From Control Point 1: south on Regional Road 12; east on Highway 20; south on Regional Road 14; south on Regional Road 16 to LF-3C	4.3 19.1	K O	23.4	87.1
	8. From Control Point 1: east on QEW; south on Regional Road 14; east on Regional Road 81; south on Regional Road 514; south on Regional Road 14; south on Regional Road 16 to LF-3C	3.5 21.9	F O	25.4	96.6
	9. From Control Point 1: east on QEW; south on Regional Road 14; east on Regional Road 81; south on Regional Road 514; south on Regional Road 14; east on Highway 20; south on Regional Road 27; west on Elcho Road (local road) to LF-3C	3.5 8.3 18.8	F K O	30.6	93.3
LF-8C	*1. From Control Point 1: east on QEW; south on Vineland Townline Road (Regional Road 24); west on Highway 20; south on Gee Road (local road) to LF-8C	13.7 4.5 17.4	F K O	35.6	90.5

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE		ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
LF-8C (cont'd)	2.	From Control Point 1: east on QEW; south on Vineland Townline Road (Regional Road 24); west on Canborough Road; west on Elcho Road; to LF-8C	13.7 20.8	F O	34.5	99.6
	3.	From Control Point 1: east on QEW; south on Regional Road 18; west on Regional Road 69; south on Regional Road 569; south on Highway 20; south on Gee Road (local road) to LF-8C	7.0 8.0 16.0	F K O	31.0	83.6
	4.	From Control Point 1: east on QEW; south on Regional Road 14; south on Regional Road 714; east on Regional Road 73; south on Regional Road 14; east on Highway 20; south on Gee Road (local road) to LF-8C	3.5 13.2 15.4	F K O	32.1	84.6
	5.	From Control Point 1: south on Regional Road 12; east on Highway 20; south on Gee Road (local road) to LF-8C	17.5 10.8	K O	28.3	67.3
	6.	From Control Point 1: east on QEW; south on Regional Road 14; east on Regional Road 81; south on Regional Road 514; south on Regional Road 14; east on Highway 20; south on Gee Road (local road) to LF-9C	3.5 13.2 13.6	F K O	30.3	76.8
LF-9C	*1.	From Control Point 1: east on QEW; south on Vineland Townline Road (Regional Road 24); west on Highway 20 to LF-9C	13.7 5.8 15.9	F K O	35.4	85.6

TABLE G-1
ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

ITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
-9C cont'd)	2. From Control Point 1: east on QEW; south on Regional Road 18; west on Regional Road 69; south on Regional Road 569; south on Highway 20 to LF-9C	7.0 6.7 14.5	F K 0	28.2	75.6
	3. From Control Point 1: east on QEW; south on Regional Road 14; south on Regional Road 714; east on Regional Road 73; south on Regional Road 14; east on Highway 20 to LF-9C	3.5 11.9 13.9	F K 0	29.3	76.6
	4. From Control Point 1: south on Regional Road 12; east on Highway 20 to LF-9C	16.2 9.3	K 0	25.5	59.3
	5. From Control Point 1: east on QEW; south on Regional Road 14; east on Regional Road 81; south on Regional Road 514; south on Regional Road 14; east on Highway 20 to LF-9C	3.5 11.9 12.1	F K 0	27.5	68.8
-1E	1. From Control Point 2: west on Merritt Road (local road); south on Highway 58 (Regional Road 50); east on Regional Road 527; east on Regional Road 27 to LF-1E	4.4 9.2	K 0	13.6	44.7
	*2. From QEW: west on Regional Road 47 (Lyons Creek Road); south on Regional Road 98 (Montrose Road); west on Carl Road (local road) to LF-1E	3.6	0	3.6	15.4

TABLE G-1

ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

SITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
LF-1E (cont'd)	3. From Control Point 2: south on 406 (proposed); east on Regional Road 27 to LF-1E	4.3 5.5	F 0	9.8	26.9
PI-27E to LF-1E	1. East on Biggar Road (Regional Road 47); south on Regional Road 98 (Montrose Road); west on Carl Road (local road) to LF-1E	3.7	0	3.7	15.9
PI-18E	*1. From Control Point 2: south on 406 (proposed); east on Regional Road 27 (East Main Street); south on Highway 140 to PI-18E	4.3 2.1 1.3	F K 0	7.7	11.4
	2. From Control Point 2: west on Merritt Road (local road); south on Regional Road 50 (Highway 58); east on Regional Road 527; east on Regional Road 27 (East Main Street); south on Highway 140 to PI-18E	6.5 5.0	K 0	11.5	29.3
LF-3E	1. From Control Point 2: west on Merritt Road (local road); south on Highway 58 (Regional Road 50); east on Regional Road 527; east on Regional Road 27; North on Regional Road 84 (Moyer Road); east on Biggar Road (Regional Road 47) to LF-3E	4.4 13.8	K 0	18.2	64.5
	*2. From QEW: west on Regional Road 47 (Lyons Creek Road/Biggar Road) to LF-3E	2.1	0	2.1	9.0
	3. From Control Point 2: south on 406 (proposed); east on Regional Road 27; north on Regional Road 84 (Moyer Road); east on Biggar Road (Regional Road 47) to LF-3E	4.3 10.1	F 0	14.4	45.6

TABLE G-1

ROUTE IDENTIFICATION AND ACCIDENT FREQUENCY CALCULATIONS

ITE	ROUTE DESCRIPTION[5]	DISTANCE (KM)	ROAD CLASS[1]	TOTAL DISTANCE (KM)	TOTAL ACCIDENT FREQUENCY[2] (acc/mil. veh.)
I-27E	1. From Control Point 2: west on Merritt Road (local road); south on Highway 58 (Regional Road 50); east on Regional Road 527; east on Regional Road 27; north on Regional Road 84 (Moyer Road); east on Biggar Road to PI-27E	4.4 13.8	K 0	18.2	64.5
	*2. From QEW: west on Regional Road 47 (Lyons Creek Road/Biggar Road); to PI-27E	1.0	0	1.0	4.3
	3. From Control Point 2: south on 406 (proposed); east on Regional Road 27; north on Regional Road 84 (Moyer Road); east on Biggar Road (Regional Road 47) to PI-27E	4.3 10.1	F 0	14.4	46.6

OTES:

. Road classifications (as per MTC)

F = Freeways K = King's Highway
S = Secondary Highway 0 = Other Roads (Regional Roads, Local Roads, etc.)

. Accident Rates (five year average)

Freeways = 0.76 (acc/mil. veh-km) King's Highway = 1.20 (acc/mil. veh-km)
Secondary Highways = 1.61 (acc/mil. veh-km) Other = 4.29 (acc/mil. veh-km)

. Control Point 1 located at QEW and Regional Road 12.

. Control Point 2 located at Highway 406 and Merritt Road.

. * Indicates which alternate route was chosen to access the site.

TABLE G-2
COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		LF-4W								PI-1N TO LF-4N
ACCESS ROUTE^4		1	2	3*	4	5	6	7	8*	1*
FACTORS	INDICATOR									
Local Access Roads^6										
1. Transportation Safety	- proximity to arterial roads (km)^1	0	0	0	0	0	0	0	0	N/A
	- number of level railway crossings on local access loads into site^{1,5}	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)^3	37.5	34.9	48.0	60.1	65.6	80.7	90.9	25.8	4.3
	- distance to freeways from site along access route (km)^1	9.6 to 401	9.0 to 401	11.2 to 401	14.0 to 401	15.3 to 401	18.8 to 403	21.2 to QEW	14.3 to QEW	N/A
	- total number of level railway crossings	3	1	2	2	2	1	1	1	1
	- number of intersections where a turn is required	3	2	1	3	1	1	1	1	2
	- haul distance between PI and LF sites (km)^2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.0

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		PI-13N TO LF-4N	LF-2N		PI-1A1 TO LF-2N		PI-13N TO LF-2N		
ACCESS ROUTE[4]		1*	1*	2*	1	2*	1	2*	3
FACTORS	INDICATOR								
Local Access Roads[6]									
1. Transportation Safety	- proximity to arterial roads (km)[1]	N/A	0	0	N/A	N/A	N/A	N/A	N/A
	- number of level railway crossings on local access loads into site[1,5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional Access Roads									
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)[3]	33.5	1.8	5.1	64.4	64.4	50.9	48.4	48.9
	- distance to freeways from site along access route (km)[1]	N/A	1.5 to 401	1.2 to 410	N/A	N/A	N/A	N/A	N/A
	- total number of level railway crossings	1	0	0	1	1	1	1	1
	- number of intersections where a turn is required	1	0	1	1	3	2	2	2
	- haul distance between PI and LF sites (km)[2]	7.8	N/A	N/A	15.0	15.0	24.3	27.1	27.2

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2
COMPARISON OF ALTERNATIVE ACCESS ROUTES

FACTORS	INDICATOR	PI-1N TO LF-2N				PI-1N				
ACCESS ROUTE[4]		1	2*	3	4	1	2	3*	4	5
Local Access Roads[6]										
1. Transportation Safety	- proximity to arterial roads (km)[1]	N/A	N/A	N/A	N/A	0	0	0	0	0
	- number of level railway crossings on local access loads into site[1,5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)[3]	63.8	52.3	49.2	60.4	31.0	42.2	36.9	53.6	68.6
	- distance to freeways from site along access route (km)[1]	N/A	N/A	N/A	N/A	8.1 from 401	10.7 from 401	8.6 from 401	12.5 from 401	16.0 from 403
	- total number of level railway crossings	1	1	2	2	2	2	1	1	0
	- number of intersections where a turn is required	1	1	2	3	2	3	1	1	1
	- haul distance between PI and LF sites (km)[2]	27.3	28.0	31.2	33.8	N/A	N/A	N/A	N/A	N/A

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		PI-1N (cont'd)		PI-13N						PI-1A1
ACCESS ROUTE[4]		6	7*	1*	2	3	4	5	6*	1
FACTORS	INDICATOR									
Local Access Roads[6]										
1. Transportation Safety	- proximity to arterial roads (km)[1]	0	0	0.4	0.4	0.4	0.4	0.4	0.4	0
	- number of level railway crossings on local access loads into site[1,5]	N/A	N/A	0	0	0	0	0	0	N/A
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)[3]	78.9	12.5	33.0	33.5	38.6	53.2	63.9	34.8	73.8
	- distance to freeways from site along access route (km)[1]	18.4 to QEW	10.4 to QEW	7.7 to 401	7.8 to 401	9.0 to 401	12.4 to 403	14.9 to QEW	16.4 to QEW	19.0 to 401
	- total number of level railway crossings	0	0	1	1	1	0	0	0	1
	- number of intersections where a turn is required	1	0	2	2	2	2	2	2	1
	- haul distance between PI and LF sites (km)[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2
COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		PI-1AI (cont'd)			LF-10W	PI-2W TO LF-10W	LF-11W	PI-2W TO LF-11W	PI-2W	LF-1C
ACCESS ROUTE^4		2*	3	4	1*	1*	1*	1*	1*	1*
FACTORS	INDICATOR									
Local Access Roads^6										
1. Transportation Safety	- proximity to arterial roads (km)^1	0	0	0	1.4	N/A	0	N/A	1.6	0.8
	- number of level railway crossings on local access loads into site^{1,5}	N/A	N/A	N/A	0	N/A	N/A	N/A	0	1
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)^3	73.8	62.2	62.2	31.6	35.2	14.4	18.0	7.5	151.6
	- distance to freeways from site along access route (km)^1	19.0 to 401	14.5 to 410	14.5 to 410	9.6 to 403E 20.0 to 403W	N/A	5.6 to 403E 16.0 to 403W	N/A	14.5 to 403W 2.1 to 403E	32.9 to QEW
	- total number of level railway crossings	1	1	1	0	0	0	0	0	4
	- number of intersections where a turn is required	4	1	3	2	3	1	2	2	3
	- haul distance between PI and LF sites (km)^2	N/A	N/A	N/A	N/A	10.0	N/A	6.0	N/A	N/A

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		LF-1C (cont'd)		PI-18E TO LF-1C	LF-3C					
ACCESS ROUTE[4]		2	3	1*	1*	2	3	4	5	6
FACTORS	INDICATOR									
Local Access Roads[6]										
1. Transportation Safety	- proximity to arterial roads (km)[1]	0.8	0.8	N/A	3.2	3.2	3.2	3.2	0	3.2
	- number of level railway crossings on local access loads into site[1,5]	1	1	N/A	0	0	0	0	N/A	0
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)[3]	57.1	75.0	44.8	119.0	146.8	100.2	101.0	104.3	83.8
	- distance to freeways from site along access route (km)[1]	16.3 to 406 (proposed)	24.4 to 406 (existing)	N/A	32.0 to QEW	31.8 to QEW	24.5 to QEW	28.9 to QEW	23.7 to QEW	28.6 to QEW
	- total number of level railway crossings	2	3	2	0	1	2	1	2	2
	- number of intersections where a turn is required	7	11	6	3	3	6	8	9	3
	- haul distance between PI and LF sites (km)[2]	N/A	N/A	12.1	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		LF-3C (cont'd)			LF-8C					
ACCESS ROUTE^4		7	8	9	1*	2	3	4	5	6
FACTORS	INDICATOR									
Local Access Roads^6										
1. Transportation Safety	- proximity to arterial roads (km)^1	0	0	3.2	1.4	2.3	1.4	1.4	1.4	1.4
	- number of level railway crossings on local access loads into site^{1,5}	N/A	N/A	0	0	0	0	0	0	0
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)^3	87.1	96.6	93.3	90.5	99.6	83.6	84.6	67.3	76.8
	- distance to freeways from site along access route (km)^1	23.4 to QEW	21.9 to QEW	27.1 to QEW	21.9 to QEW	20.8 to QEW	24.0 to QEW	28.6 to QEW	28.3 to QEW	26.8 to QEW
	- total number of level railway crossings	3	2	1	0	1	2	1	2	1
	- number of intersections where a turn is required	9	12	6	2	3	7	9	4	7
	- haul distance between PI and LF sites (km)^2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		LF-9C					LF-1E			PI-27E TO LF-1E
ACCESS ROUTE^4		1*	2	3	4	5	1	2*	3	1*
FACTORS	INDICATOR									
Local Access Roads^6										
1. Transportation Safety	- proximity to arterial roads (km)^1	0	0	0	0	0	0	1.7	0	N/A
	- number of level railway crossings on local access loads into site^{1,5}	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional Access Roads										
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)^3	85.6	75.6	76.6	59.3	68.8	44.7	15.4	26.9	15.9
	- distance to freeways from site along access route (km)^1	21.7 to QEW	21.2 to QEW	25.8 to QEW	25.5 to QEW	24.0 to QEW	13.6 to 406 (existing)	3.6 to QEW	5.5 to 406 (proposed)	N/A
	- total number of level railway crossings	0	2	1	2	1	2	0	2	0
	- number of intersections where a turn is required	1	6	8	3	6	4	2	0	2
	- haul distance between PI and LF sites (km)^2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.7

NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

TABLE G-2

COMPARISON OF ALTERNATIVE ACCESS ROUTES

SITE		PI-18E		LF-3E			PI-27E		
ACCESS ROUTE[4]		1*	2	1	2*	3	1	2*	3
FACTORS	INDICATOR								
Local Access Roads[6]									
1. Transportation Safety	- proximity to arterial roads (km)[1]	0	0	0	0	0	0	0	0
	- number of level railway crossings on local access loads into site[1,5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional Access Roads									
1. Transportation Safety	- transportation accident frequency (accidents/million vehicles)[3]	11.4	29.3	64.5	9.0	46.6	64.5	4.3	46.6
	- distance to freeways from site along access route (km)[1]	3.4 to 406 (proposed)	11.5 to 406 (existing)	18.2 to 406 (existing)	2.1 to QEW	10.1 to 406 (proposed)	18.2 to 406 (existing)	1.0 to QEW	10.1 to 406 (proposed)
	- total number of level railway crossings	0	1	3	0	2	3	0	2
	- number of intersections where a turn is required	1	5	6	0	2	6	0	2
	- haul distance between PI and LF sites (km)[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

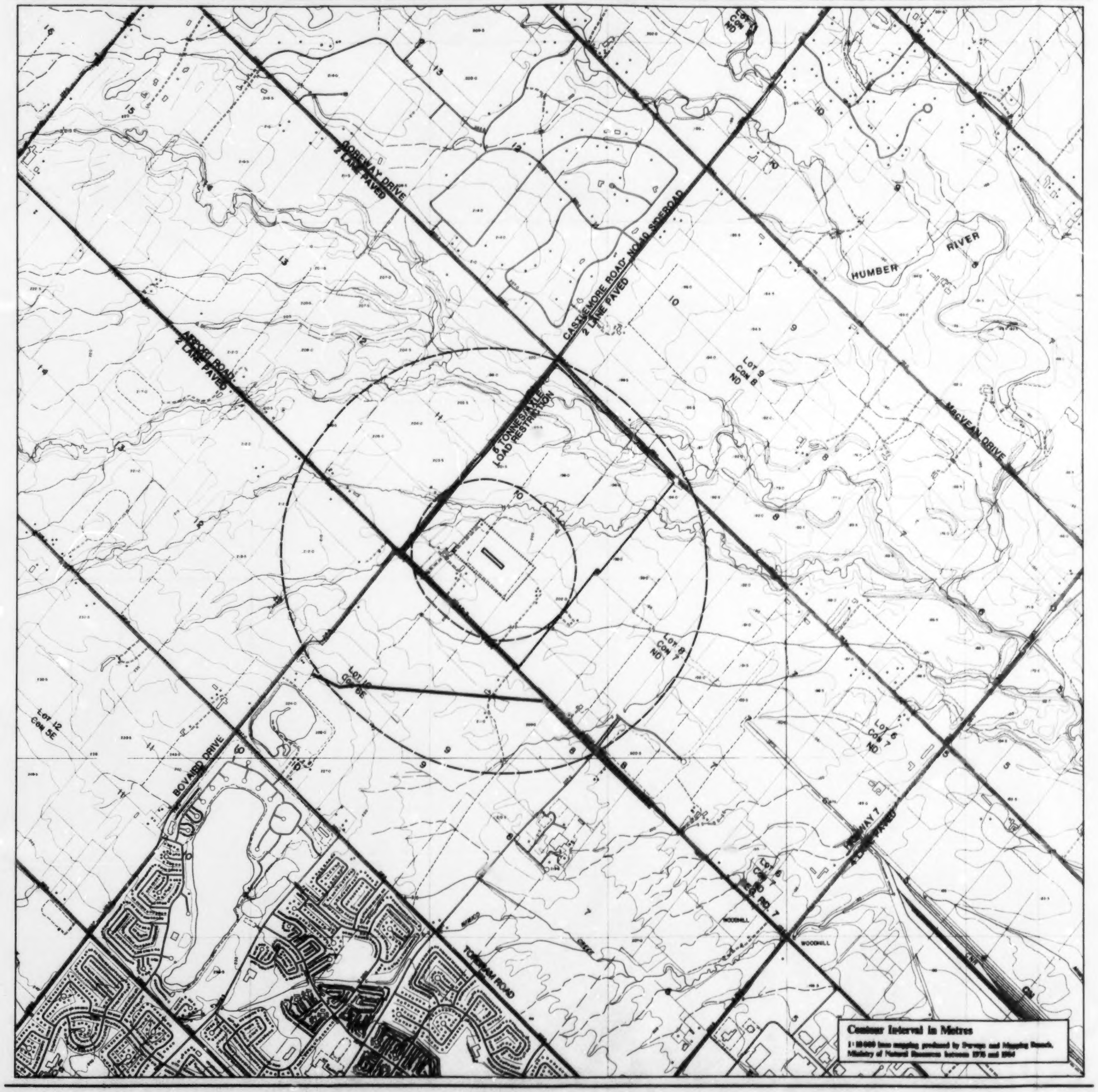
NOTES:

1. This indicator does not apply to routes between PI and LF sites.
2. This indicator applies only to routes between PI and LF sites.
3. See Table G-1 for derivation of accident frequency value.
4. See Table G-1 for alternative route descriptions; * = selected route.
5. When the proximity to an arterial road is 0 km, this indicator does not apply.
6. Local access roads are the roads connecting the site to an arterial road or provincial highway.

APPENDIX H

MAPS OF THE 16 POTENTIAL SITES

TRANSPORTATION DATA


GOREWAY DRIVE
2 LANE PAVED
CASTLEMORE ROAD/ NO 40 SIDEROAD
2 LANE PAVED
AIRPORT ROAD
2 LANE PAVED
5 TONNES/AXLE
LOAD RESTRICTION
HUMBER RIVER
McVEAN DRIVE
BOVAIRD DRIVE
TORBRAM ROAD
HIGHWAY 7
4 LANE PAVED
WOODHILL
Lot 9
CON 8
ND
Lot 8
CON 7
ND
Lot 6
CON 7
ND
Lot 12
CON SE
Contour Interval in Metres
1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1984

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

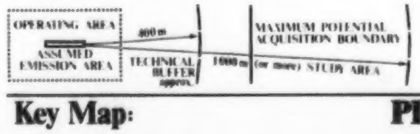
Hydro Line

Pipeline

Telephone Line

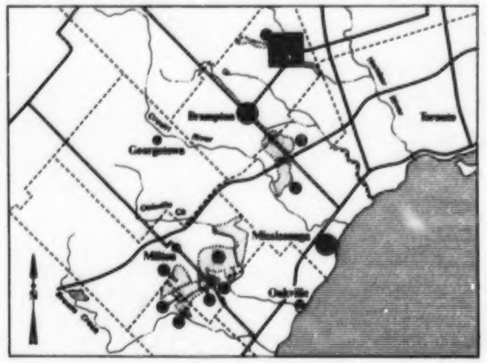
A/G - Above Ground

B/G - Below Ground


OPERATING AREA
ASSUMED
EMISSION AREA
400 m
TECHNICAL
BUFFER
approx.
1000 m
MAXIMUM POTENTIAL
ACQUISITION BOUNDARY
(or more) STUDY AREA

Key Map: **PI - 1A1**

Lot 10 and Part of Lot 9; Concession VII; City of Brampton, formerly the Toronto Gore

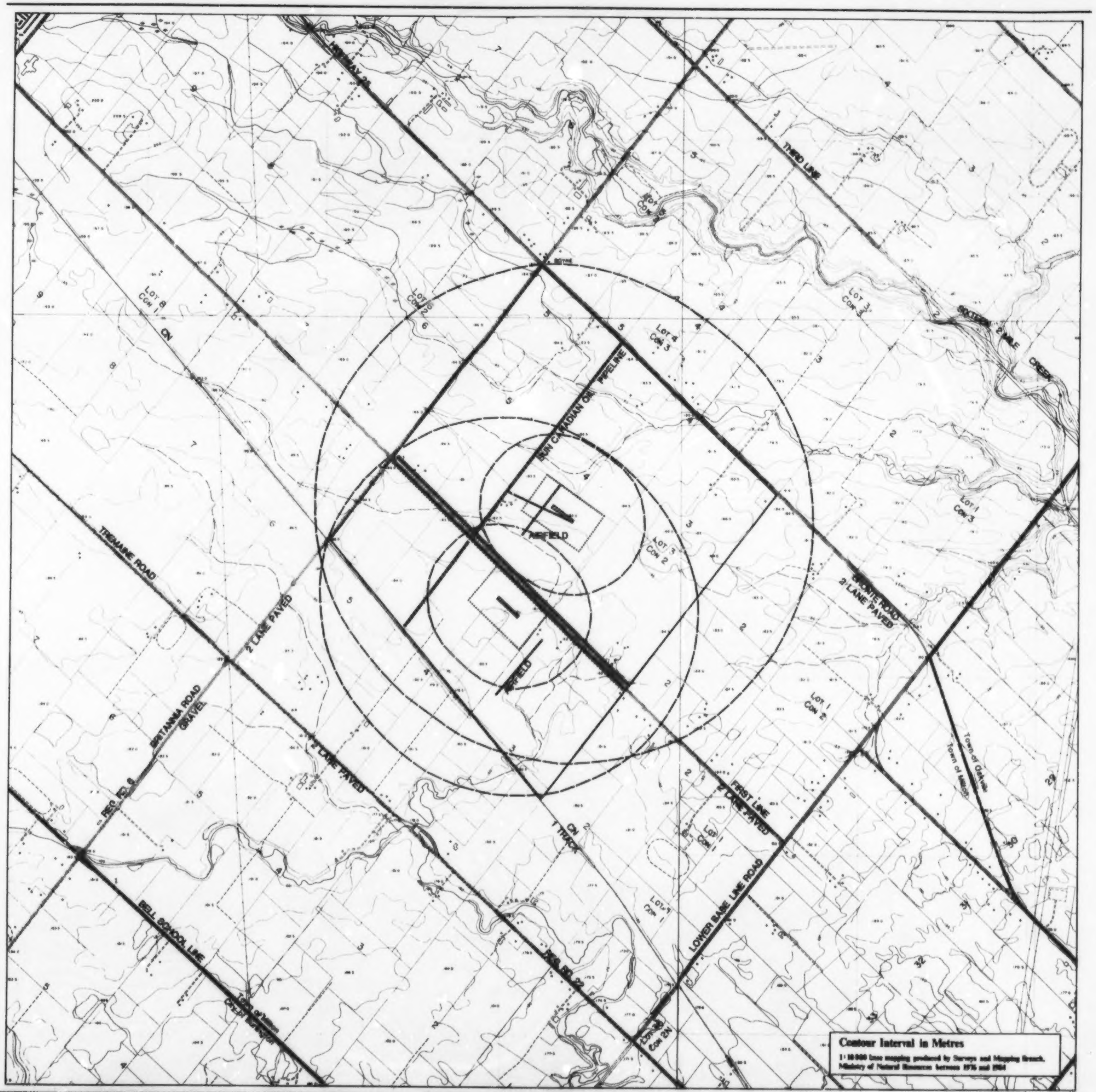

Brampton
Georgetown
Toronto
Mississauga
Milton
Oakville

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-18


THIRD LINE
SIXTEEN MILE CREEK
BOYNE
SUN CANADIAN OIL PIPELINE
AIRFIELD
AIRFIELD
LOT 4 CON 3
LOT 3 CON 3
LOT 1 CON 3
LOT 8 CON 1
LOT 5 CON 2
LOT 1 CON 2
LOT 1 CON 1
BRONTE ROAD 2 LANE PAVED
TREMAINE ROAD
2 LANE PAVED
BRITANNIA ROAD GRAVEL
REG. RD. 6
2 LANE PAVED
FIRST LINE 2 LANE PAVED
LOWER BASE LINE ROAD
BELL SCHOOL LINE
REG. RD. 22
Town of Oakville
Town of Milton
Town of Milton
Town of Oakville

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1984

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

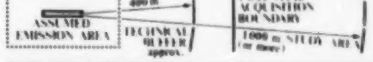
Hydro Line

Pipeline

Telephone Line

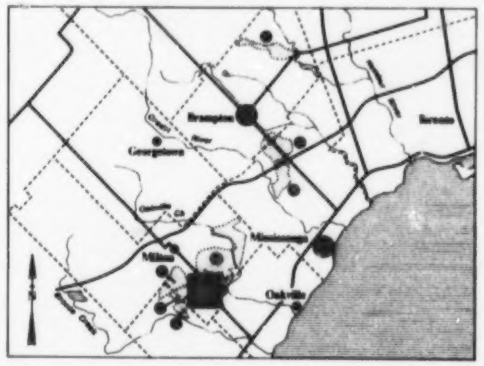
A/G – Above Ground

B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000 m STUDY AREA (or more)

Key Map: PI-1 North

Lots 3, 4 and 5; Concession II; Town of Milton; Parts of Lots 3, 4 and 5; Concession I; Town of Milton, formerly in the Township of Trafalgar

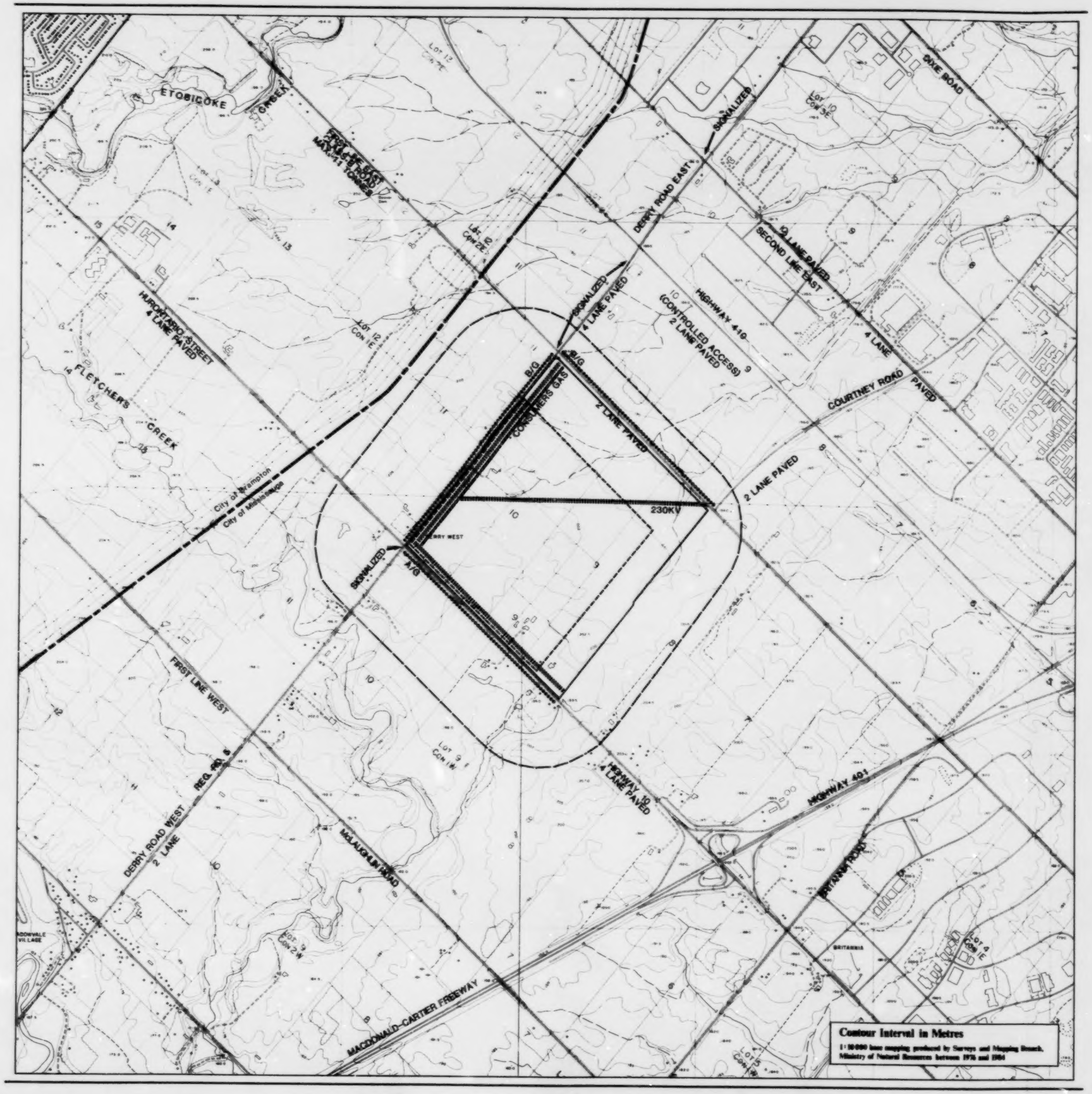

Brampton
Georgetown
Toronto
Mississauga
Milton
Oakville

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-19


ETOBICOKE CREEK
FIRST LINE EAST
DIXIE ROAD
DERRY ROAD EAST
SIGNALIZED
2 LANE PAVED
SECOND LINE EAST
HIGHWAY 410 (CONTROLLED ACCESS) 2 LANE PAVED
4 LANE PAVED
4 LANE
COURTNEY ROAD PAVED
HURONTARIO STREET 4 LANE PAVED
FLETCHERS CREEK
CONSUMERS GAS
B/G
A/G
230KV
DERRY WEST
City of Brampton
City of Mississauga
FIRST LINE WEST
REG. RD. 5
DERRY ROAD WEST 2 LANE
McLAUGHLIN ROAD
HIGHWAY 10 4 LANE PAVED
HIGHWAY 401
MACDONALD-CARTIER FREEWAY
BRITANNIA
MEADOWVALE VILLAGE
Lot 12
Lot 10
Lot 9
Lot 5
Con 1 E
Con 1 W

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1984

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

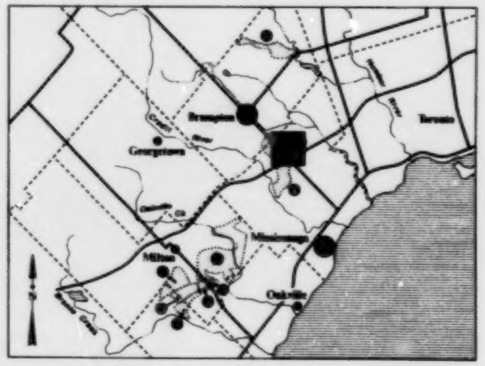
- Hydro Line
- Pipeline
- Telephone Line

A/G ~ Above Ground
B/G ~ Below Ground

LIMIT OF LANDFILL approx.
not to scale
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
500 metres
STUDY AREA

Key Map: **LF-2 North**

Lots 9 and 10; Concession I EHS (East of Hurontario Street), City of Mississauga

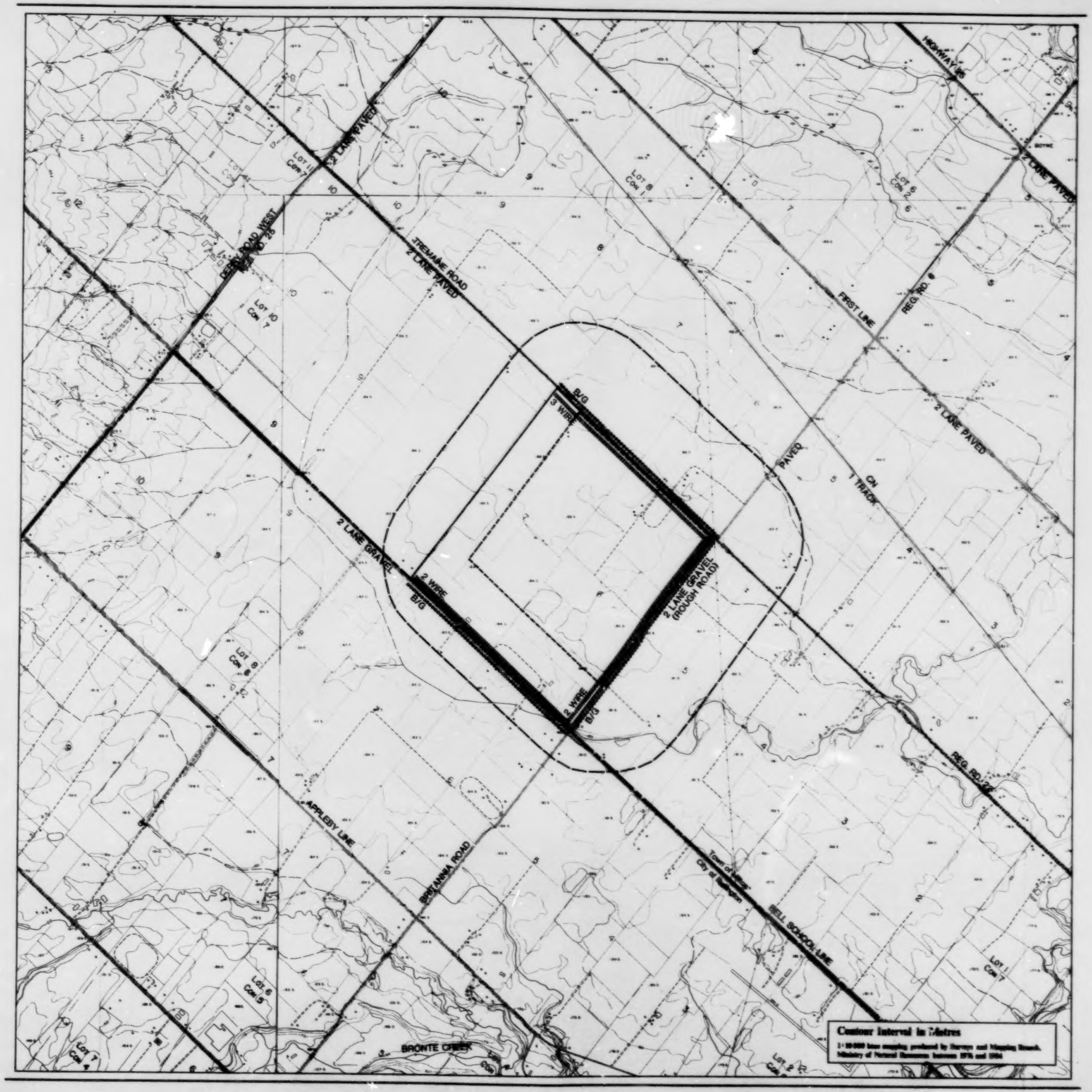

Brampton
Georgetown
Toronto
Milton
Mississauga
Oakville

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-20


HIGHWAY 25
2 LANE PAVED
TREMAINE ROAD
2 LANE PAVED
DERRY ROAD WEST
REG. RD. 25
LOT 10 CON 7
LOT 11 CON 7
LOT 8 CON 1
LOT 6 CON 2
FIRST LINE
REG. RD. 6
2 LANE PAVED
PAVED
CN 1 TRACK
B/G
3 WIRE
2 WIRE
B/G
2 LANE GRAVEL
2 LANE GRAVEL (ROUGH ROAD)
2 WIRE
B/G
REG. RD. 22
LOT 8 CON 8
APPLEBY LINE
BRITANNIA ROAD
Town of Milton
City of Burlington
BELL SCHOOL LINE
LOT 6 CON 5
LOT 7 CON 4
LOT 2 CON 1
LOT 1 CON 7
BRONTE CREEK
BOYNE

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between [illegible] and [illegible]

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

- Hydro Line
- Pipeline
- Telephone Line
  - A/G – Above Ground
  - B/G – Below Ground

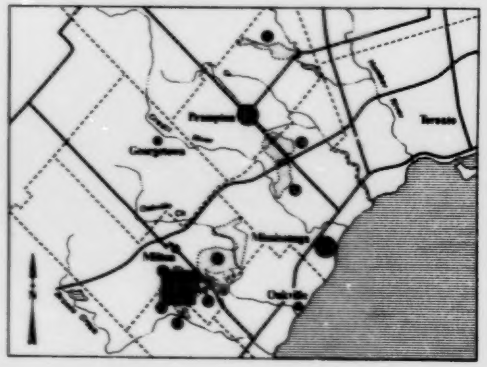
LIMITS OF LANDFILL approx.
not to scale

MAXIMUM POTENTIAL ACQUISITION BOUNDARY

500 m STUDY AREA

Key Map: **LF- 4 North**

Lots 6 and 7; Concession VII; Town of Milton, formerly in the Township of Nelson

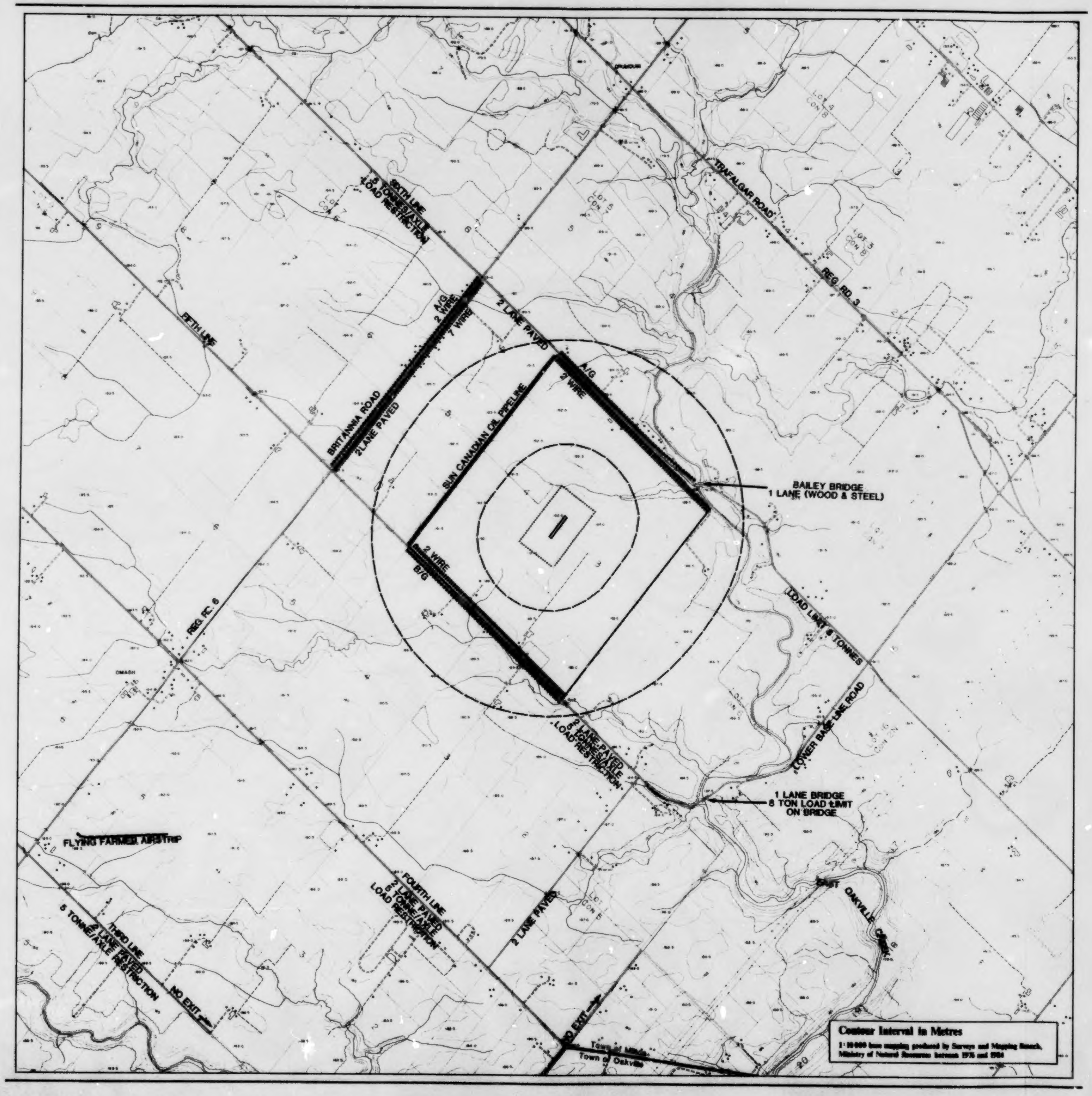

Brampton
Georgetown
Toronto
Milton
Mississauga
Oakville

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-21


SIXTH LINE
5 TONNE/AXLE LOAD RESTRICTION
TRAFALGAR ROAD
REG. RD. 3
FIFTH LINE
A/G
2 WIRE
7 WIRE
2 LANE PAVED
BRITANNIA ROAD
2 LANE PAVED
SUN CANADIAN OIL PIPELINE
A/G
2 WIRE
BAILEY BRIDGE
1 LANE (WOOD & STEEL)
2 WIRE
B/G
REG. RC. 6
LOAD LIMIT 5 TONNES
LOWER BASE LINE ROAD
2 LANE PAVED
5 TONNE/AXLE LOAD RESTRICTION
1 LANE BRIDGE
8 TON LOAD LIMIT ON BRIDGE
FLYING FARMER AIRSTRIP
FOURTH LINE
2 LANE PAVED
5 TONNE/AXLE LOAD RESTRICTION
THIRD LINE
2 LANE PAVED
5 TONNE/AXLE RESTRICTION
NO EXIT
2 LANE PAVED
NO EXIT
EAST OAKVILLE CREEK
Town of Milton
Town of Oakville

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1984

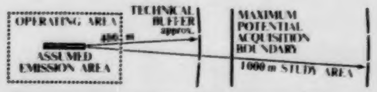
OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

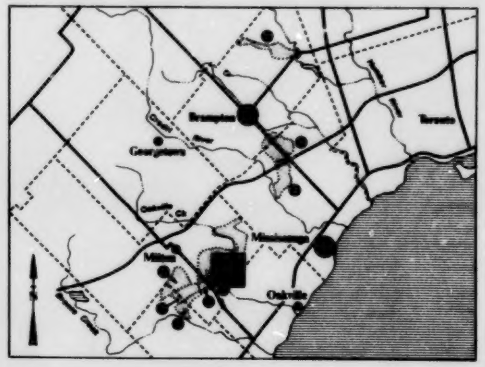
Legend:

- ······· Hydro Line
- —— Pipeline
- ······· Telephone Line
  - A/G – Above Ground
  - B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
TECHNICAL BUFFER approx.
400 m
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000 m STUDY AREA

Key Map: **PI-13 North**

Lots 3 and 4; Concession VI; Town of Milton, formerly the Township of Trafalgar

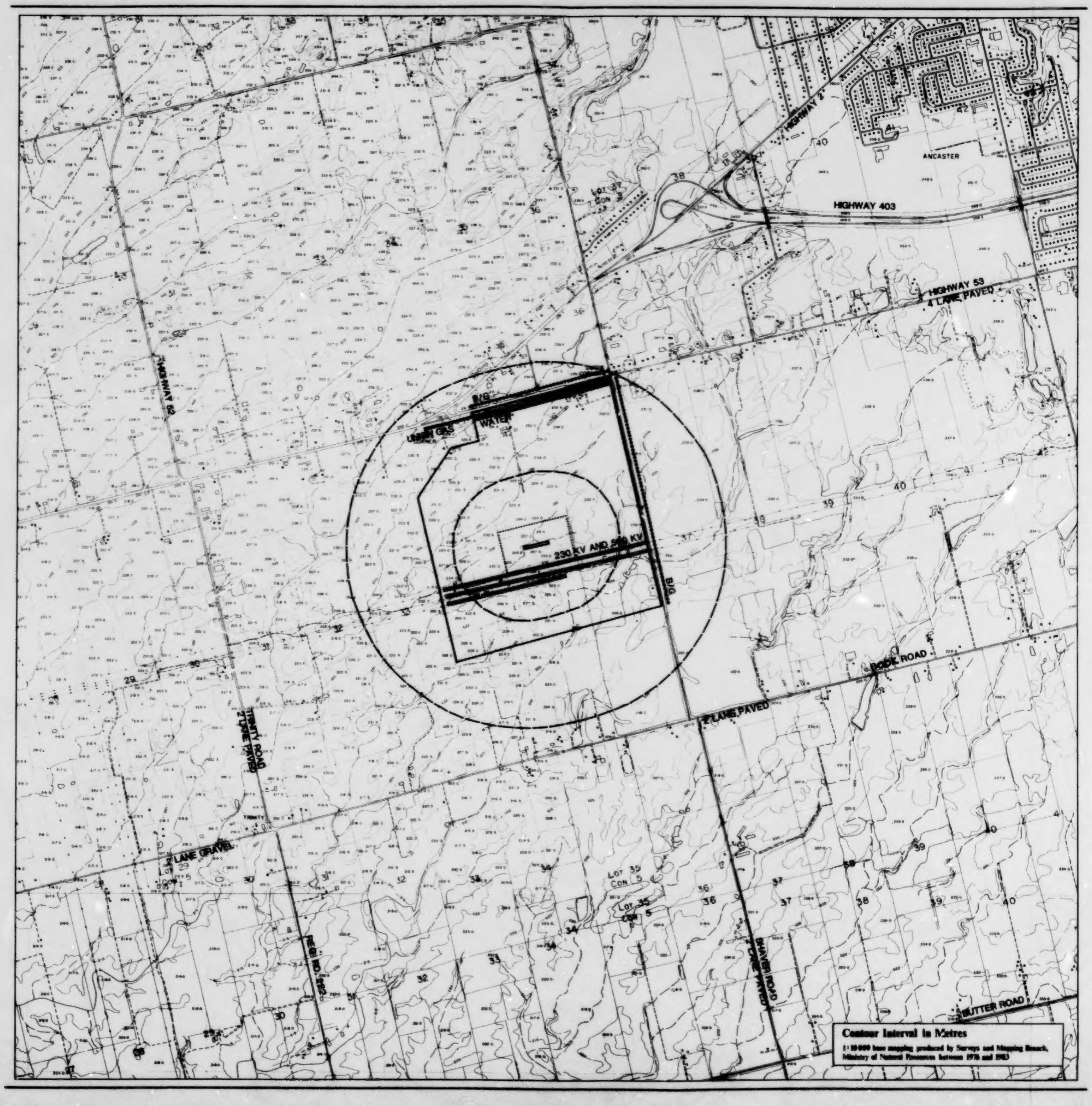

Brampton
Georgetown
Toronto
Mississauga
Milton
Oakville
N

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT·22


HIGHWAY 2
ANCASTER
HIGHWAY 403
LOT 37 CON 3
HIGHWAY 53
4 LANE, PAVED
HIGHWAY 52
UNION GAS
WATER
B/G
230 KV AND 500 KV
B/G
DOOL ROAD
2 LANE, PAVED
TRINITY ROAD
2 LANE PAVED
2 LANE GRAVEL
LOT 35 CON 5
SHAVER ROAD
2 LANE PAVED
BUTTER ROAD

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:
Dillon
Consulting Engineers & Planners

Legend:

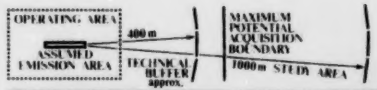
▪▪▪▪▪▪ Hydro Line

▬▬ Pipeline

┅┅┅ Telephone Line

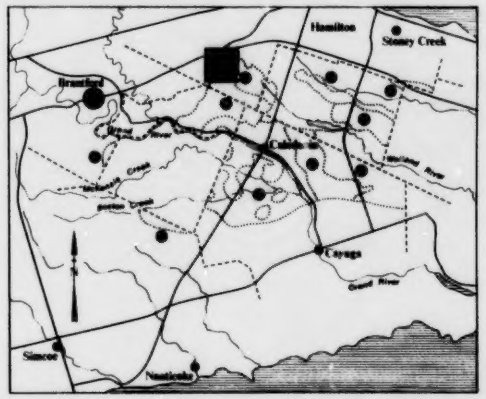
A/G - Above Ground

B/G - Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000 m STUDY AREA

Key Map: **PI - 2 West**

Part of Lots 34, 35 and 36; Concession IV; Town of Ancaster

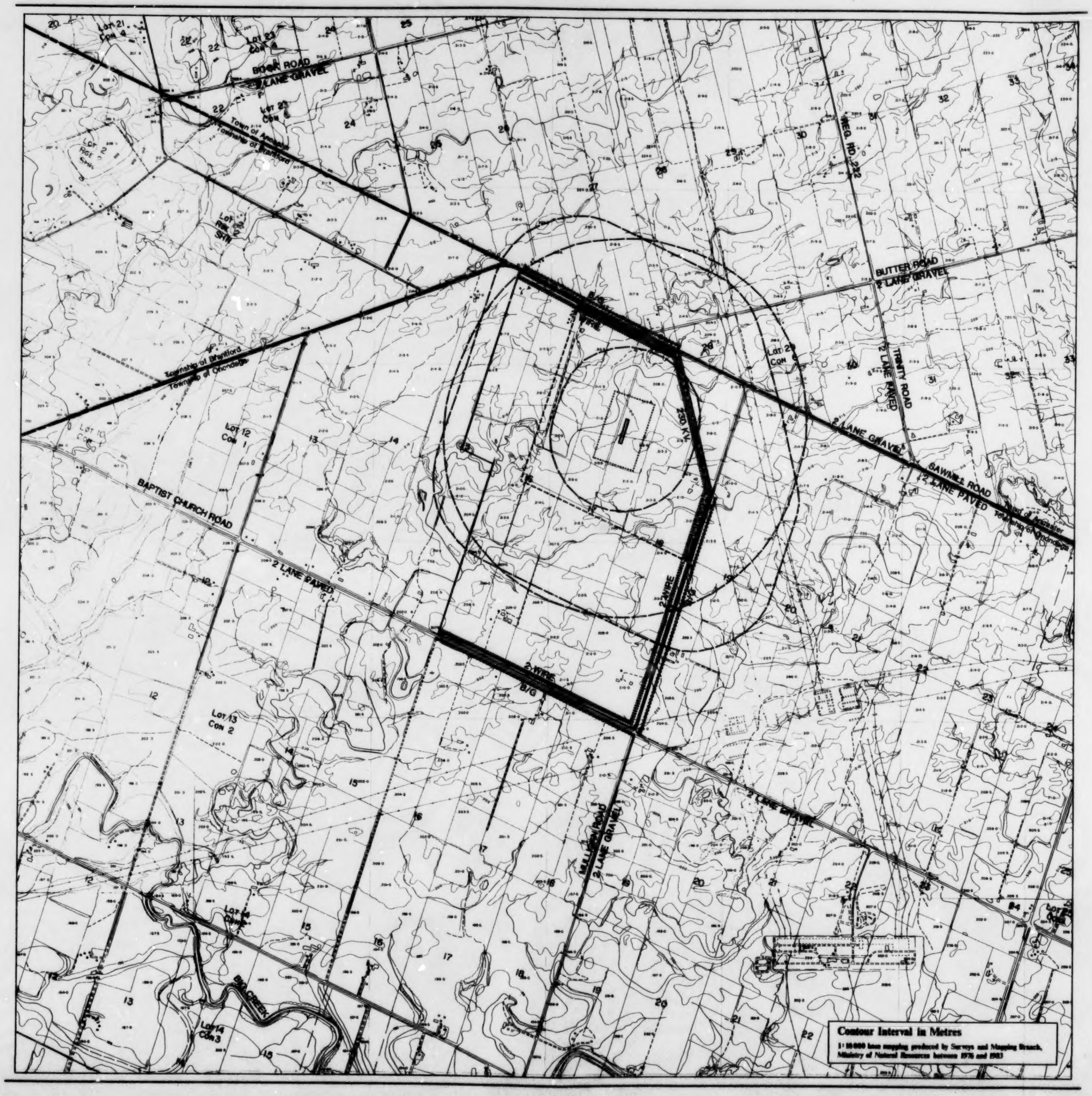

Hamilton
Stoney Creek
Brantford
Caledonia
Cayuga
Grand River
Simcoe
Nanticoke

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-23


BOCK ROAD
2 LANE GRAVEL
Town of Ancaster
Township of Brantford
Township of Brantford
Township of Onondaga
LOT 12 CON 1
LOT 13 CON 2
LOT 14 CON 3
BAPTIST CHURCH ROAD
2 LANE PAVED
BUTTER ROAD
2 LANE GRAVEL
REG. RD. 22
TRINITY ROAD
2 LANE PAVED
2 LANE GRAVEL
SAWMILL ROAD
2 LANE PAVED
Town of Ancaster
Township of Onondaga
230 KV
2-WIRE
B/G
MULLIGAN ROAD
2 LANE GRAVEL
2 LANE GRAVEL
BIG CREEK

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

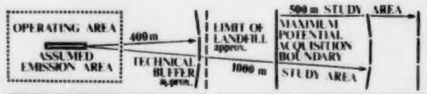
OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

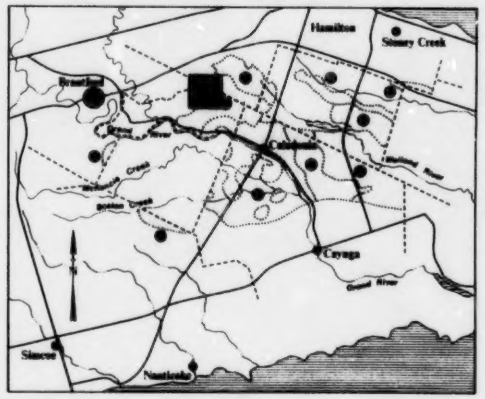
Legend:

Hydro Line
Pipeline
Telephone Line
A/G ~ Above Ground
B/G ~ Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
LIMIT OF LANDFILL approx.
1000 m
500 m STUDY AREA
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
STUDY AREA

Key Map: **LF-10a West**

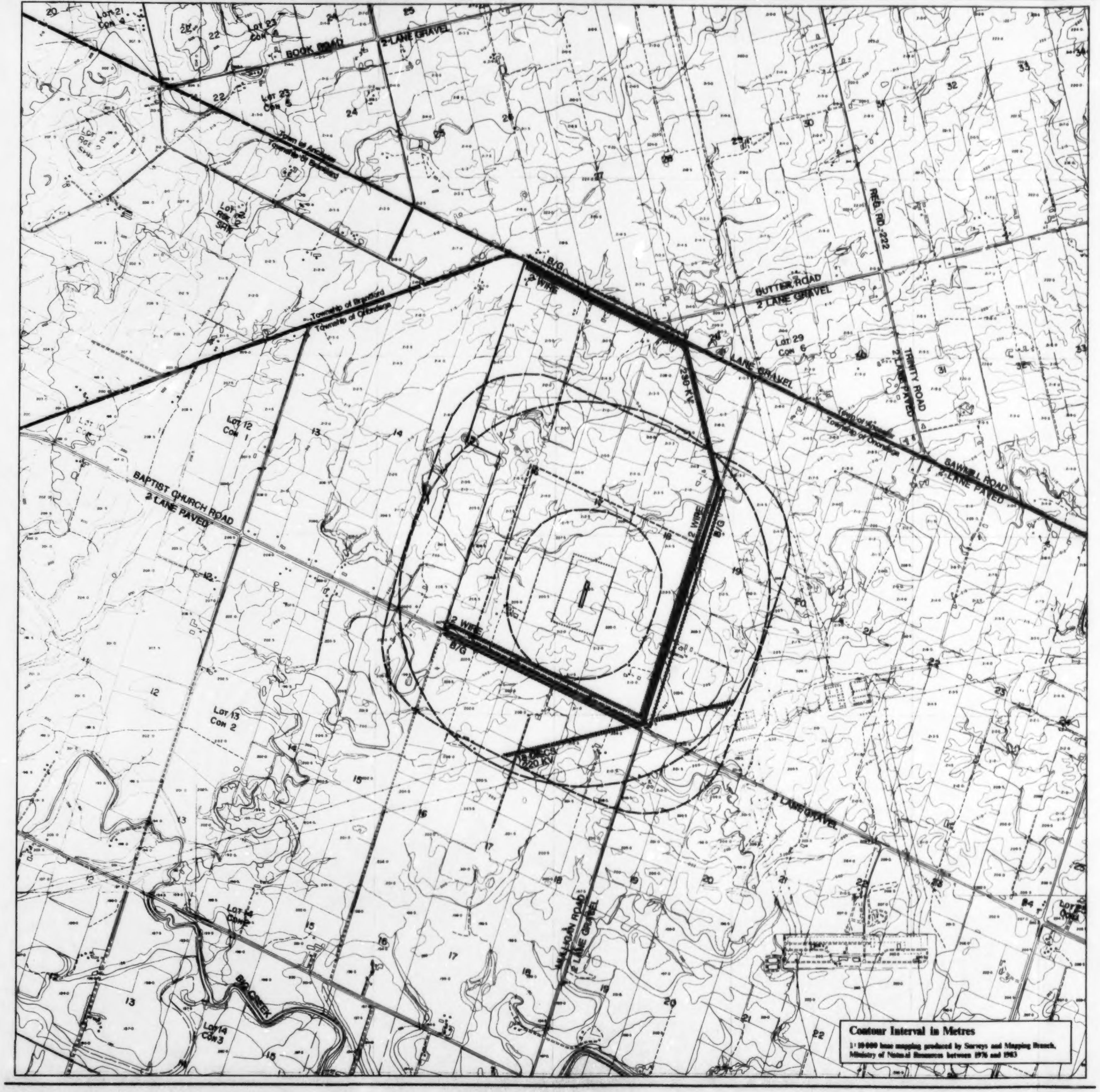
Lots 16, 17 and Part of Lots 15 and 18; Concession I; Township of Onondaga


Hamilton
Stoney Creek
Brantford
Caledonia
Cayuga
Grand River
Simcoe
Nanticoke

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984 **MAP DT-24**


BOOK ROAD
2 LANE GRAVEL
Lot 21 Con 4
Lot 23 Con 4
Lot 23 Con 5
Township of Brantford
Township of Onondaga
BUTTER ROAD 2 LANE GRAVEL
REG. RD. 22
TRINITY ROAD 2 LANE PAVED
Lot 29 Con 6
SAWMILL ROAD 2 LANE PAVED
B/G
2 WIRE
230 KV
Lot 12 Con 1
BAPTIST CHURCH ROAD 2 LANE PAVED
Lot 13 Con 2
2 CIRCS 220 KV
MULLIGAN ROAD 2 LANE GRAVEL
2 LANE GRAVEL
Lot 14 Con 2
Lot 14 Con 3
BIG CREEK

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON Consulting Engineers & Planners

Legend:

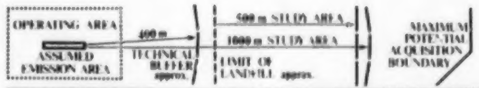
┅┅┅ Hydro Line

—— Pipeline

┄┄┄ Telephone Line

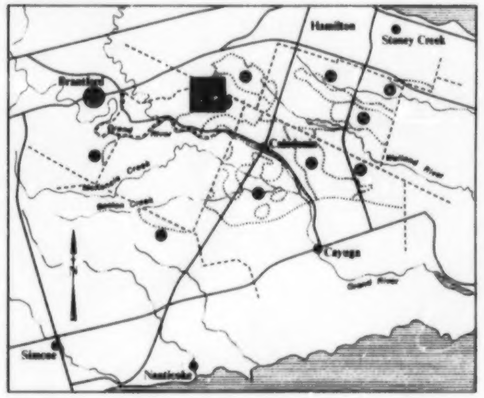
A/G – Above Ground

B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
500 m STUDY AREA
1000 m STUDY AREA
LIMIT OF LANDFILL approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY

Key Map: **LF-10b West**

Lots 16, 17 and Part of Lots 15 and 18; Concession I; Township of Onondaga

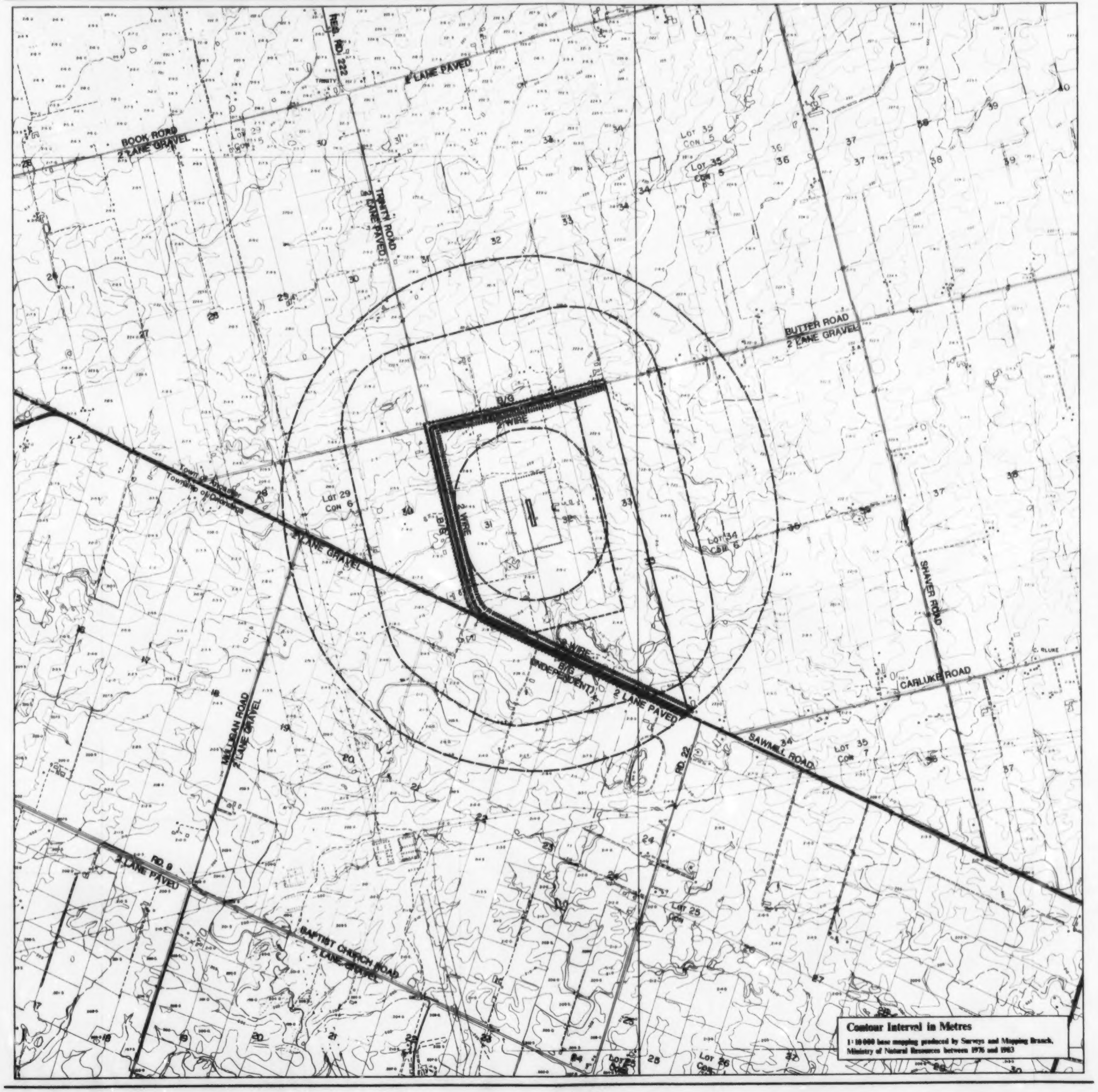

Hamilton
Stoney Creek
Brantford
Cayuga
Simcoe
Nanticoke
Grand River

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-25


HWY. RD. 222
TRINITY
2 LANE PAVED
BOOK ROAD
2 LANE GRAVEL
LOT 29 CON 5
LOT 35 CON 5
TRINITY ROAD
LANE PAVED
BUTTER ROAD
2 LANE GRAVEL
B/G
2 WIRE
LOT 29
CON 6
LOT 34
CON 6
Town of Ancaster
Township of Glanbrook
2 LANE GRAVEL
SHAVER ROAD
C. RLUKE
CARLUKE ROAD
2 WIRE
B/G
(INDEPENDENT)
2 LANE PAVED
SAWMILL ROAD
LOT 35
CON 7
RD. 22
WILLIAMS ROAD
2 LANE GRAVEL
RD. 9
2 LANE PAVED
BAPTIST CHURCH ROAD
2 LANE GRAVEL
LOT 25
LOT 26

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

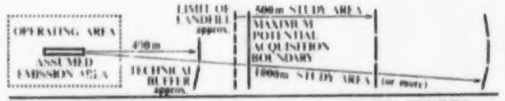
OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

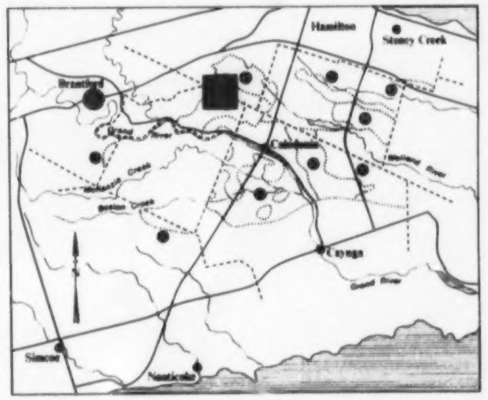
Legend:

Hydro Line
Pipeline
Telephone Line
A/G - Above Ground
B/G - Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
450 m
LIMIT OF LANDFILL approx.
TECHNICAL BUFFER approx.
500m STUDY AREA
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000m STUDY AREA (or more)

Key Map: **LF-11 West**

Lots 31, 32 and Part of Lot 33, Concession VI; Town of Ancaster

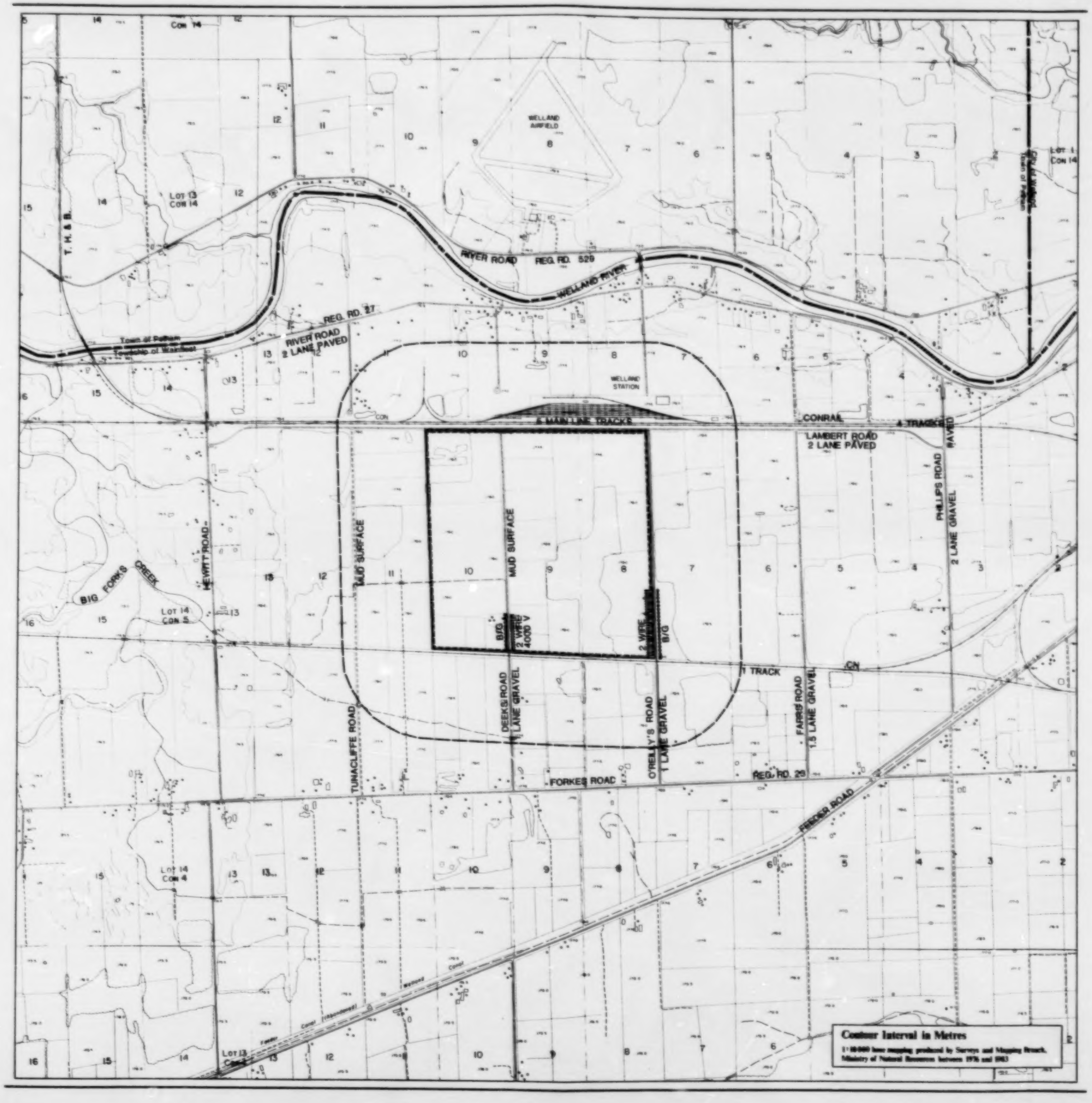

Hamilton
Stoney Creek
Brantford
Grand River
Caledonia
Cayuga
Grand River
Simcoe
Nanticoke

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-26


WELLAND AIRFIELD
CON 14
LOT 13 CON 14
LOT 1 CON 14
T. H. & B.
RIVER ROAD REG. RD. 529
WELLAND RIVER
REG. RD. 27
RIVER ROAD 2 LANE PAVED
Town of Pelham
Township of Wainfleet
WELLAND STATION
CON
6 MAIN LINE TRACKS
CONRAIL
4 TRACKS
LAMBERT ROAD 2 LANE PAVED
PHILLIPS ROAD 2 LANE GRAVEL
PAVED
MUD SURFACE
MUD SURFACE
B/G
2 WIRE 4000 V
2 WIRE
B/G
1 TRACK
CN
BIG FORKS CREEK
HEWITT ROAD
LOT 14 CON 5
TUNACLIFFE ROAD
DEEKS ROAD 1 LANE GRAVEL
O'REILLY'S ROAD 1 LANE GRAVEL
FARRS ROAD 1.5 LANE GRAVEL
FORKES ROAD
REG. RD. 29
FEEDER ROAD
LOT 14 CON 4
LOT 13 CON 5
Welland Canal
Feeder Canal (Abandoned)

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

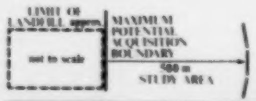
OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

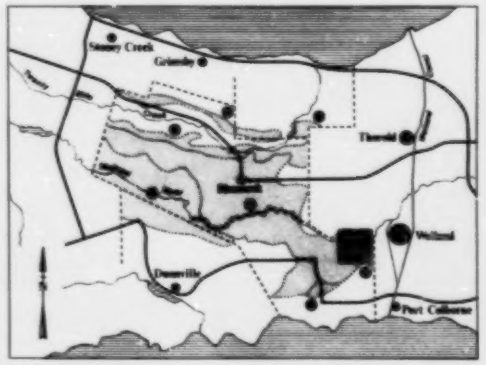
Legend:

- Hydro Line
- Pipeline
- Telephone Line
  - A/G - Above Ground
  - B/G - Below Ground


LIMIT OF LANDFILL approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
not to scale
500 m
STUDY AREA

Key Map: **LF-1 Central**

Part of Lots 8, 9, and 10; Concession V; Township of Wainfleet

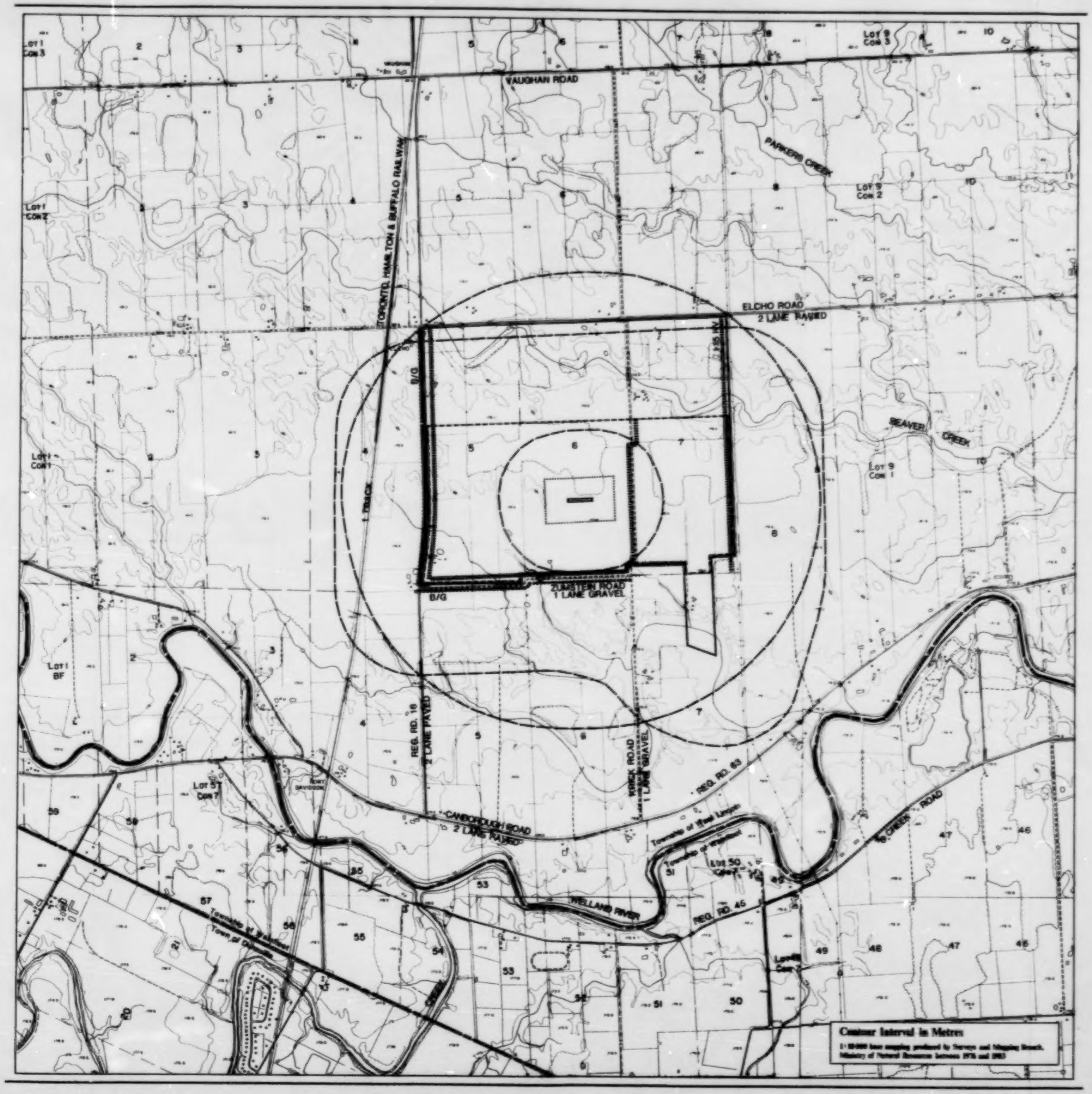

Stoney Creek
Grimsby
Thorold
Welland
Dunnville
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-27


LOT 1 CON 3
LOT 9 CON 3
VAUGHAN ROAD
TORONTO, HAMILTON & BUFFALO RAILWAY
PARKERS CREEK
LOT 1 CON 2
LOT 9 CON 2
ELCHO ROAD 2 LANE PAVED
B/G
1 TRACK
LOT 1 CON 1
BEAVER CREEK
LOT 9 CON 1
ZUMSTEIN ROAD 1 LANE GRAVEL
LOT 1 BF
REG. RD. 16 2 LANE PAVED
YORK ROAD 1 LANE GRAVEL
REG. RD. 63
CANBOROUGH ROAD 2 LANE PAVED
LOT 57 CON 7
Township of West Lincoln
Township of Wainfleet
LOT 50 CON 7
CREEK ROAD
WELLAND RIVER
REG. RD. 45
Township of Wainfleet
Town of Dunnville

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1978 and 1983

OWMC Ontario Waste Management Corporation

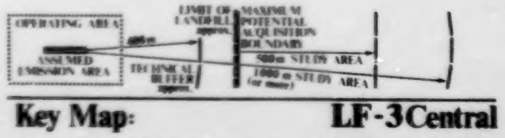
Consultant:

DILLON
Consulting Engineers & Planners

Legend:

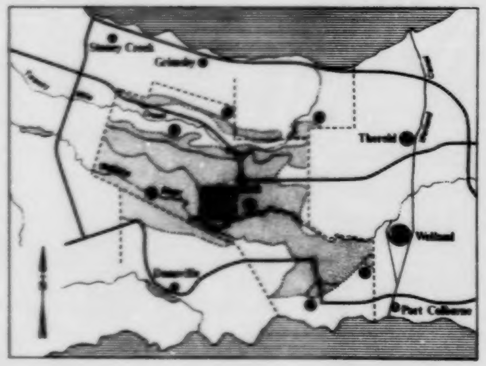
- Hydro Line
- Pipeline
- Telephone Line

A/G – Above Ground
B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
LIMIT OF LANDFILL approx.
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
500m STUDY AREA
1000 m STUDY AREA (or more)

Key Map: **LF-3 Central**

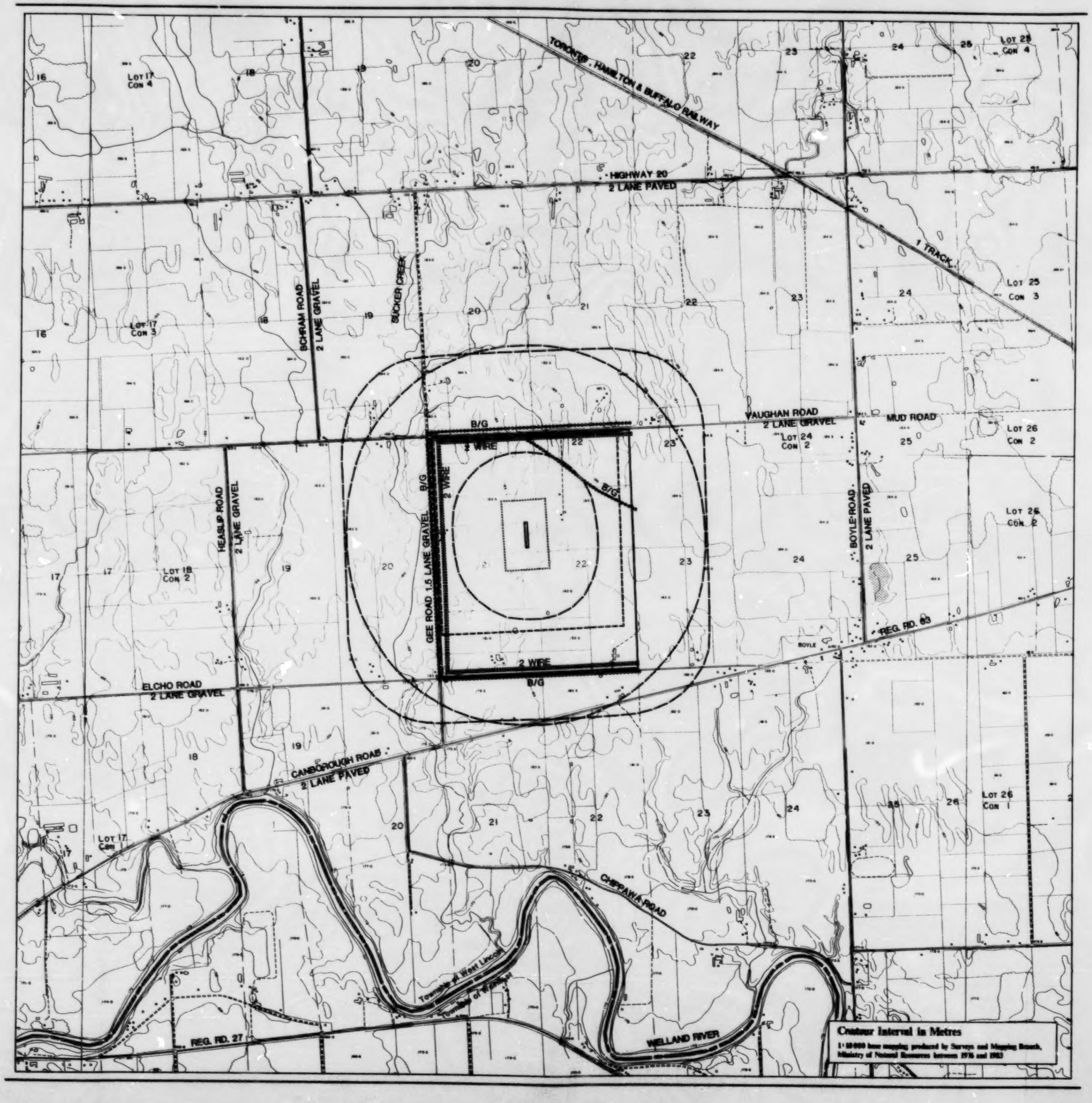
Lots 5, 6 and 7; Concession I; Part of Lot 7; Broken Front Concession; Township of West Lincoln; formerly in the Township of Gainsborough


Stoney Creek
Grimsby
Thorold
Welland
Dunnville
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984 **MAP DT-28**


TORONTO, HAMILTON & BUFFALO RAILWAY
1 TRACK
HIGHWAY 20
2 LANE PAVED
SCHRAM ROAD
2 LANE GRAVEL
SUCKER CREEK
VAUGHAN ROAD
2 LANE GRAVEL
MUD ROAD
HEASLIP ROAD
2 LANE GRAVEL
GEE ROAD 1.5 LANE GRAVEL
BOYLE ROAD
2 LANE PAVED
ELCHO ROAD
2 LANE GRAVEL
CANBOROUGH ROAD
2 LANE PAVED
REG. RD. 63
BOYLE
CHIPPAWA ROAD
REG. RD. 27
WELLAND RIVER
Township of West Lincoln
Township of Wainfleet
B/G
2 WIRE
LOT 17 CON 4
LOT 17 CON 3
LOT 18 CON 2
LOT 17 CON 1
LOT 24 CON 2
LOT 25 CON 4
LOT 25 CON 3
LOT 26 CON 2
LOT 26 CON 1
Contour Interval in Metres
1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

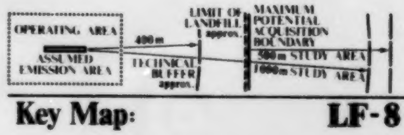
Consultant:

DILLON
Consulting Engineers & Planners

Legend:

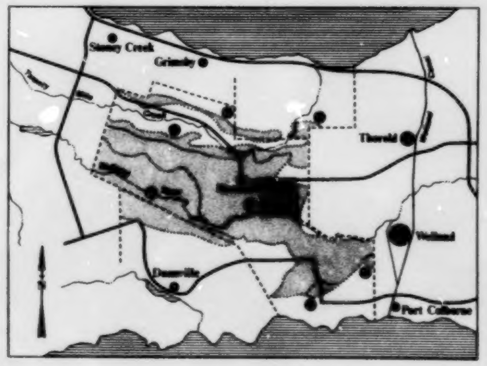
- Hydro Line
- Pipeline
- Telephone Line

A/G - Above Ground
B/G - Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
LIMIT OF LANDFILL approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
500 m STUDY AREA
1000 m STUDY AREA

Key Map: **LF-8 Central**

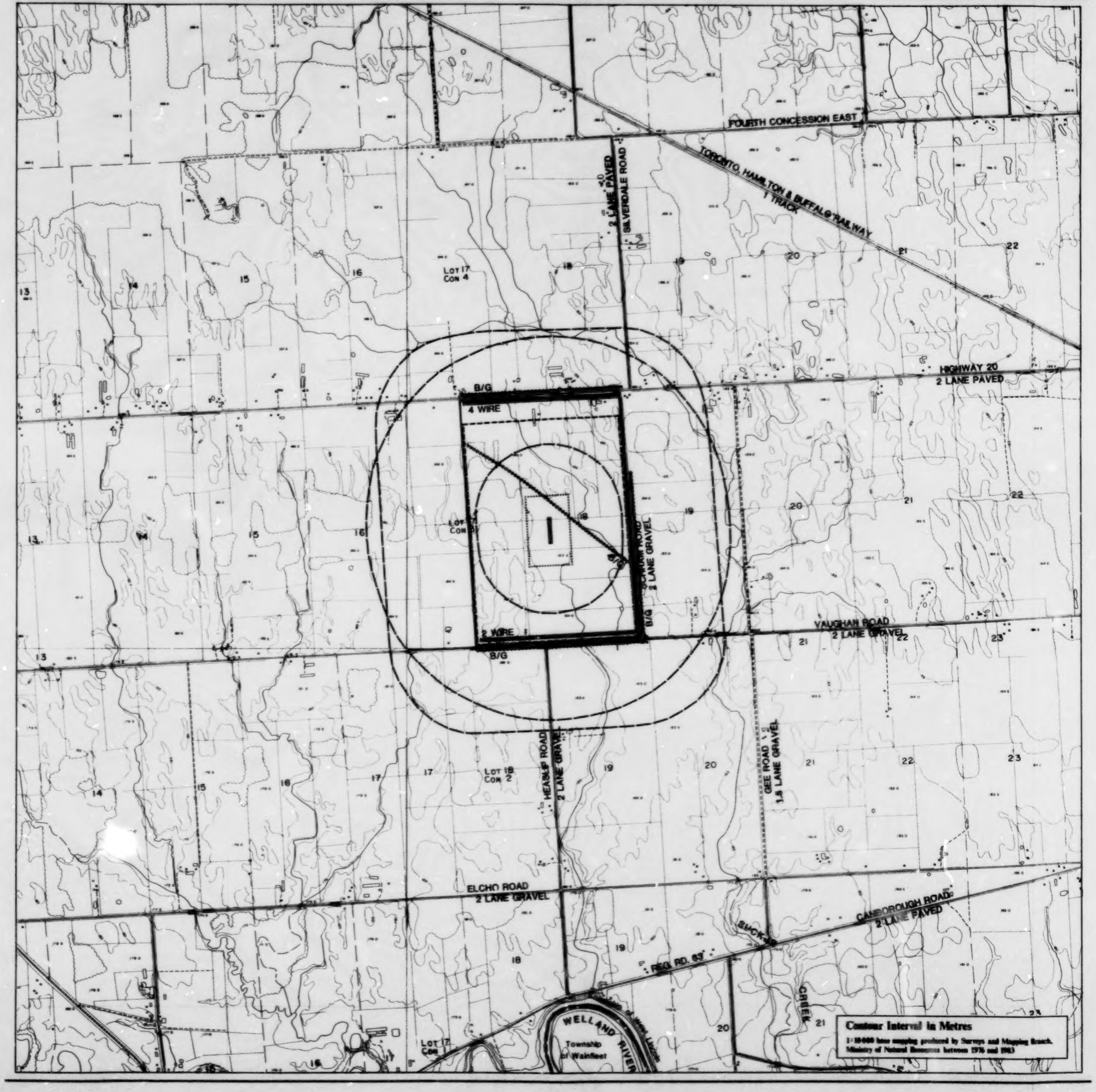
Lots 21 and 22; Concession II; Township of West Lincoln; formerly in the Township of Gainsborough


Stoney Creek
Grimsby
Thorold
Welland
Dunnville
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984 **MAP DT-29**


FOURTH CONCESSION EAST
TORONTO, HAMILTON & BUFFALO RAILWAY
1 TRACK
2 LANE PAVED
SILVERDALE ROAD
LOT 17
CON 4
HIGHWAY 20
2 LANE PAVED
B/G
4 WIRE
2 WIRE
B/G
2 LANE GRAVEL
VAUGHAN ROAD
2 LANE GRAVEL
HEASLIP ROAD
2 LANE GRAVEL
LOT 18
CON 2
GEE ROAD
1.5 LANE GRAVEL
ELCHO ROAD
2 LANE GRAVEL
CANBOROUGH ROAD
2 LANE PAVED
REG. RD. 63
BUCKHORN CREEK
WELLAND RIVER
Township of Wainfleet
LOT 17
CON
13
14
15
16
17
18
19
20
21
22
23

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

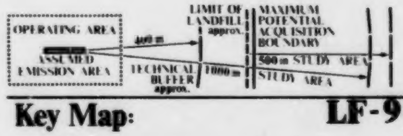
Hydro Line

Pipeline

Telephone Line

A/G ~ Above Ground

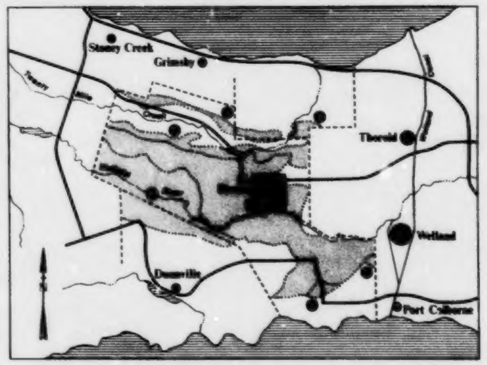
B/G ~ Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
LIMIT OF LANDFILL approx.
1000 m
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
500 m STUDY AREA
STUDY AREA

Key Map:

LF-9 Central

Lot 18 and Part of Lot 17; Concession III; Township of West Lincoln; formerly in the Township of Gainsborough

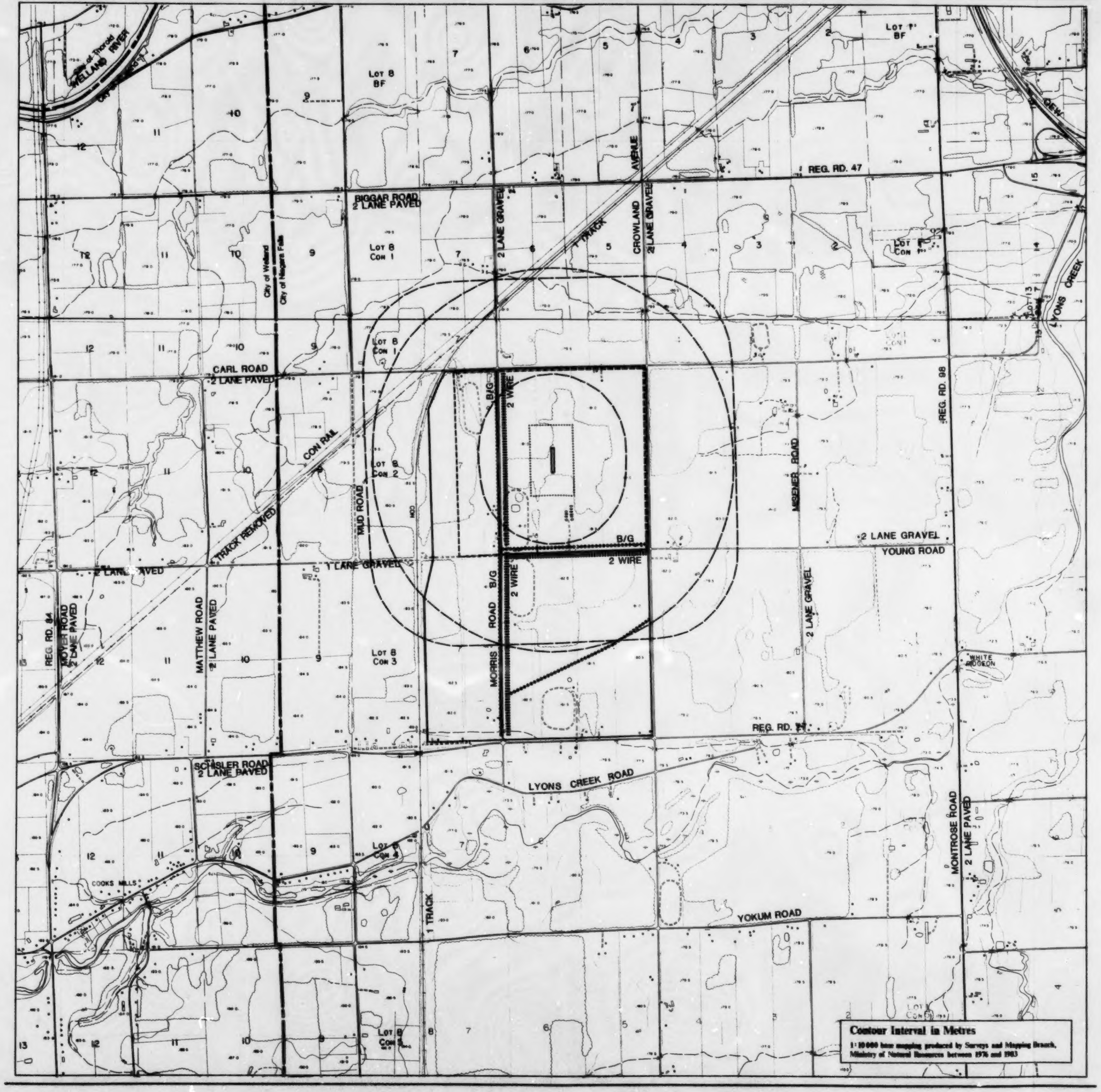

Stoney Creek
Grimsby
Thorold
Welland
Dunnville
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-30


Welland River
City of Thorold
Lot 8 BF
Lot 7 BF
Reg. Rd. 47
QEW
Biggar Road 2 Lane Paved
2 Lane Gravel
1 Track
Crowland Avenue 2 Lane Gravel
Lot 8 Con 1
Lot 1 Con 1
City of Welland
City of Niagara Falls
Lyons Creek
Carl Road 2 Lane Paved
Con Rail
Track Removed
Mud Road
Lot 8 Con 2
B/G
2 Wire
Reg. Rd. 98
Misener Road
2 Lane Gravel
Young Road
1 Lane Gravel
2 Lane Paved
Reg. Rd. 84
Moyer Road 2 Lane Paved
Matthew Road 2 Lane Paved
Morris Road
Lot 8 Con 3
White Pigeon
Reg. Rd. 27
Schisler Road 2 Lane Paved
Lyons Creek Road
Lot 8 Con 4
Cooks Mills
1 Track
Montrose Road 2 Lane Paved
Yokum Road
Lot 8 Con 5
Lot 1 Con 5

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

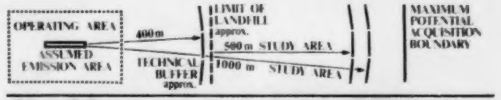
Hydro Line

Pipeline

Telephone Line

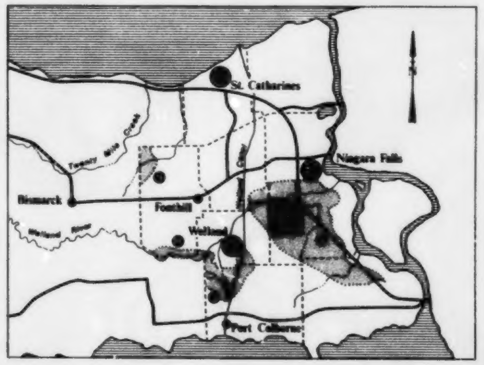
A/G - Above Ground

B/G - Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
LIMIT OF LANDFILL approx.
500 m STUDY AREA
1000 m STUDY AREA
MAXIMUM POTENTIAL ACQUISITION BOUNDARY

Key Map: **LF-1a East**

Lots 5, 6 and 7; Concessions II and III; City of Niagara Falls; formerly in the Township of Crowland

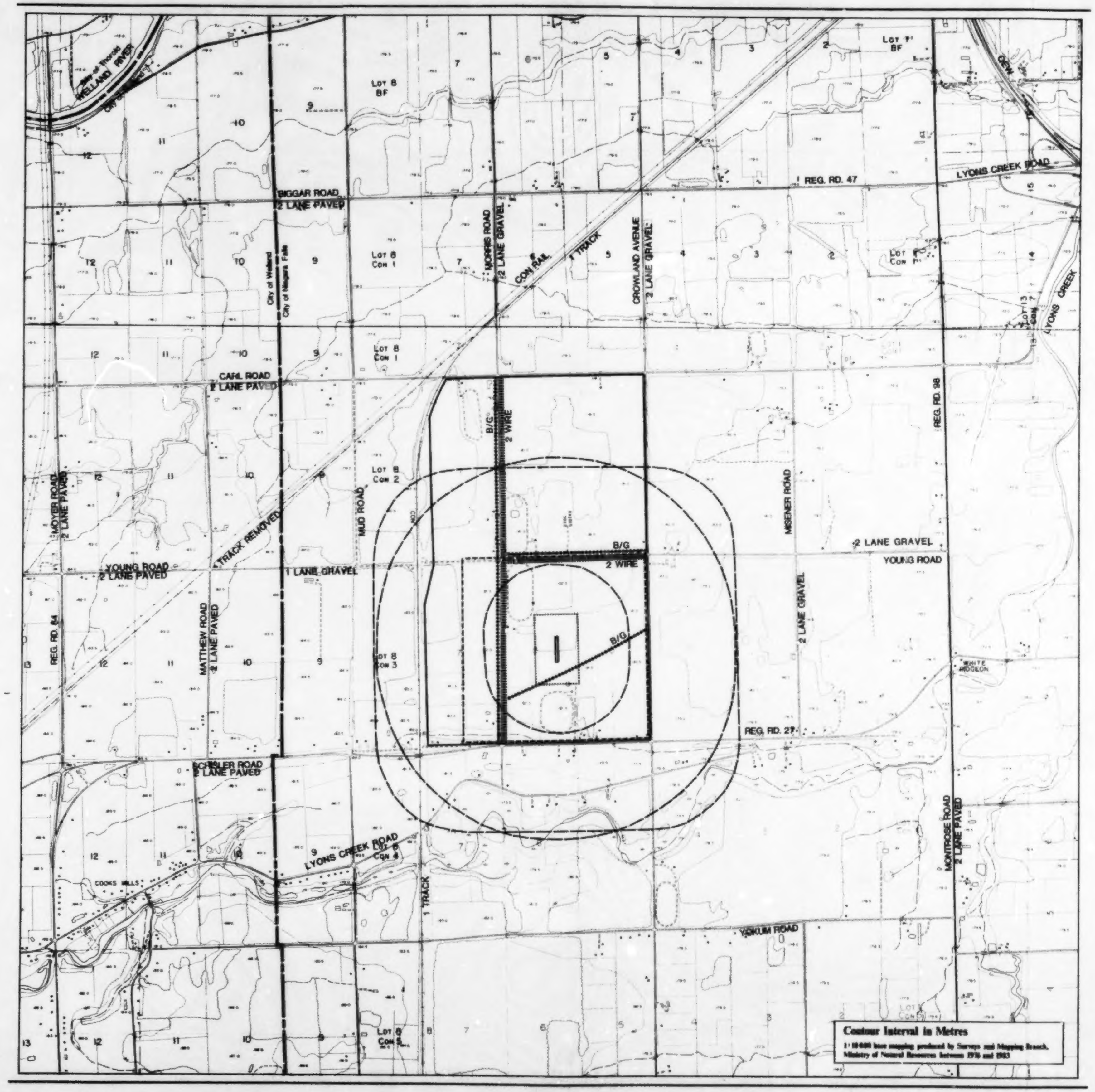

St. Catharines
Niagara Falls
Bismarck
Fonthill
Welland
Port Colborne
Welland River

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-31



WELLAND RIVER
City of Thorold
City of Welland
City of Niagara Falls
BIGGAR ROAD 2 LANE PAVED
REG. RD. 47
LYONS CREEK ROAD
MORRIS ROAD 2 LANE GRAVEL
CON RAIL 1 TRACK
CROWLAND AVENUE 2 LANE GRAVEL
LOT 8 BF
LOT 8 CON 1
LOT 8 CON 2
LOT 8 CON 3
LOT 8 CON 4
LOT 8 CON 5
LOT 13 CON 7
LYONS CREEK
QEW
CARL ROAD 2 LANE PAVED
B/G
2 WIRE
REG. RD. 98
MOYER ROAD 2 LANE PAVED
TRACK REMOVED
MUD ROAD
MISENER ROAD
2 LANE GRAVEL
YOUNG ROAD 2 LANE PAVED
YOUNG ROAD
1 LANE GRAVEL
REG. RD. 84
MATTHEW ROAD 2 LANE PAVED
WHITE PIGEON
REG. RD. 27
SCHISLER ROAD 2 LANE PAVED
LYONS CREEK ROAD
COOKS MILLS
1 TRACK
MONTROSE ROAD 2 LANE PAVED
YOKUM ROAD

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

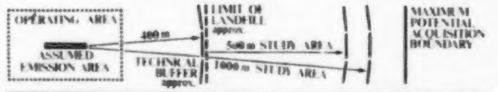
OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

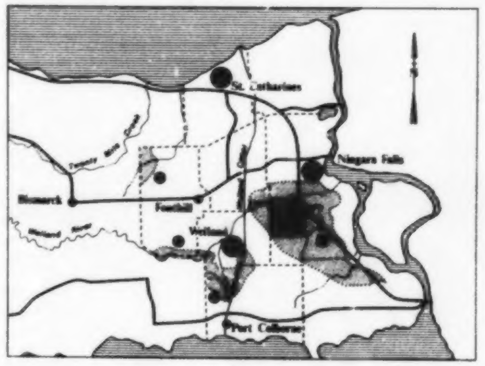
- Hydro Line
- Pipeline
- Telephone Line
  - A/G ~ Above Ground
  - B/G ~ Below Ground



OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
LIMIT OF LANDFILL approx.
500 m STUDY AREA
1000 m STUDY AREA
MAXIMUM POTENTIAL ACQUISITION BOUNDARY

Key Map: **LF - 1b East**

Lots 5, 6 and 7; Concessions II and III; City of Niagara Falls; formerly in the Township of Crowland



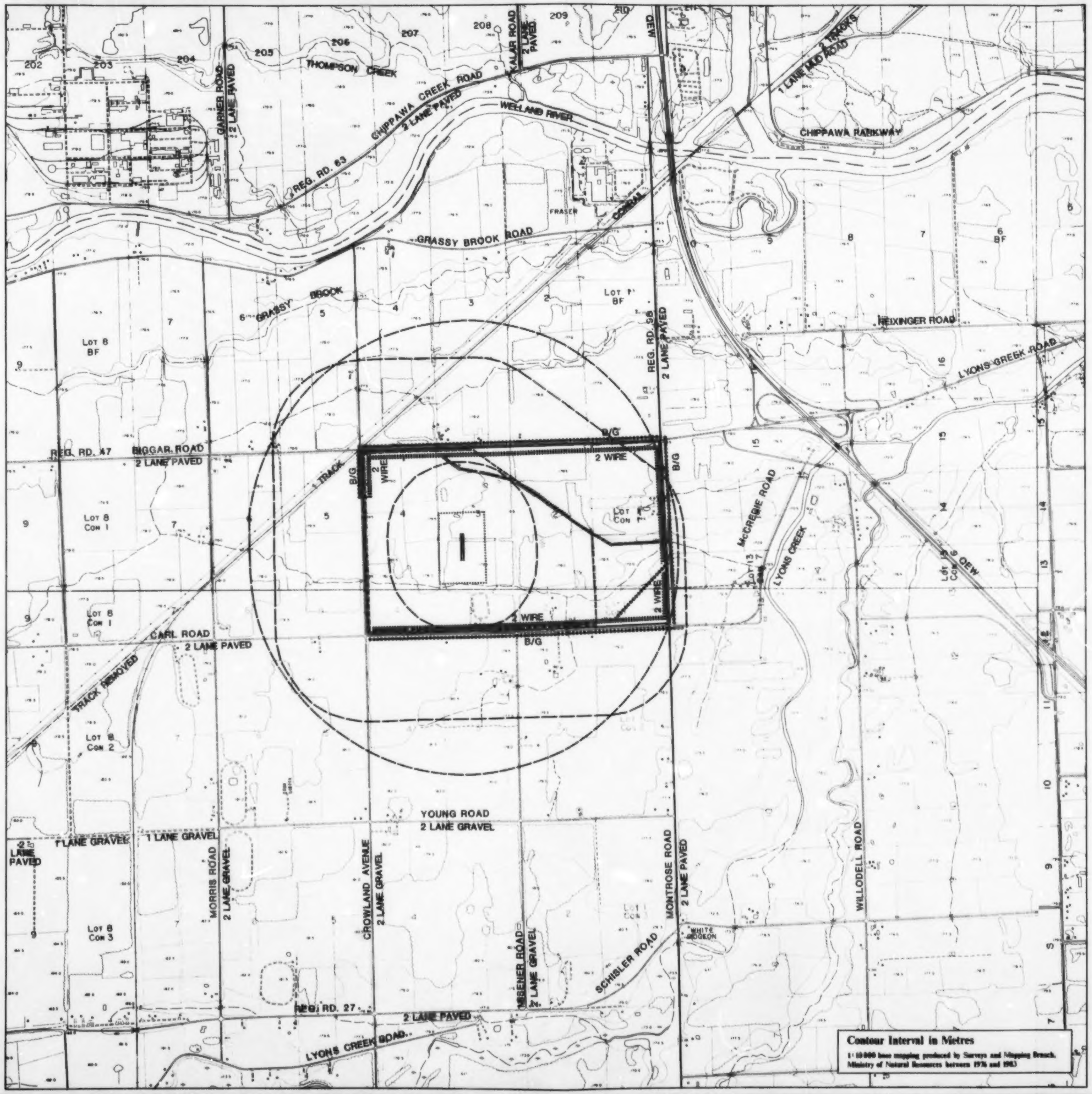
St. Catharines
Niagara Falls
Bismarck
Fonthill
Welland
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-32


THOMPSON CREEK
CHIPPAWA CREEK ROAD
2 LANE PAVED
REG. RD. 63
WELLAND RIVER
KALAR ROAD
2 LANE PAVED
GARNER ROAD
2 LANE PAVED
QEW
2 TRACKS
1 LANE MUD ROAD
CHIPPAWA PARKWAY
GRASSY BROOK ROAD
GRASSY BROOK
FRASER
CANAL
REG. RD. 58
2 LANE PAVED
REIXINGER ROAD
LYONS CREEK ROAD
REG. RD. 47
BIGGAR ROAD
2 LANE PAVED
1 TRACK
B/G
2 WIRE
McCREDIE ROAD
LYONS CREEK
CARL ROAD
2 LANE PAVED
TRACK REMOVED
YOUNG ROAD
2 LANE GRAVEL
1 LANE GRAVEL
MORRIS ROAD
2 LANE GRAVEL
CROWLAND AVENUE
2 LANE GRAVEL
BEENER ROAD
2 LANE GRAVEL
MONTROSE ROAD
2 LANE PAVED
WILLODELL ROAD
SCHISLER ROAD
WHITE PIGEON
REG. RD. 27
2 LANE PAVED
LYONS CREEK ROAD
Lot 8 BF
Lot 8 Con 1
Lot 8 Con 2
Lot 8 Con 3
QEW

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON
Consulting Engineers & Planners

Legend:

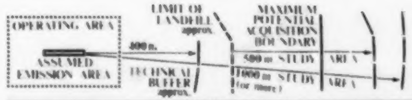
Hydro Line

Pipeline

Telephone Line

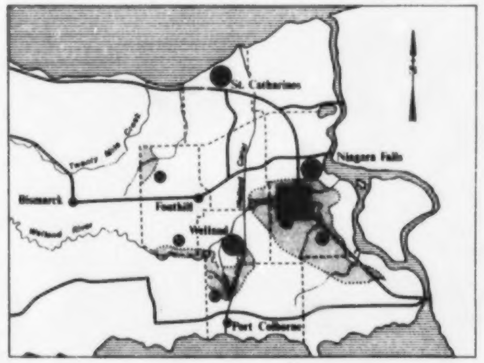
A/G – Above Ground

B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
300 m.
LIMIT OF LANDFILL approx.
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
500 m STUDY AREA
1000 m STUDY AREA (or more)

Key Map: **LF-3 East**

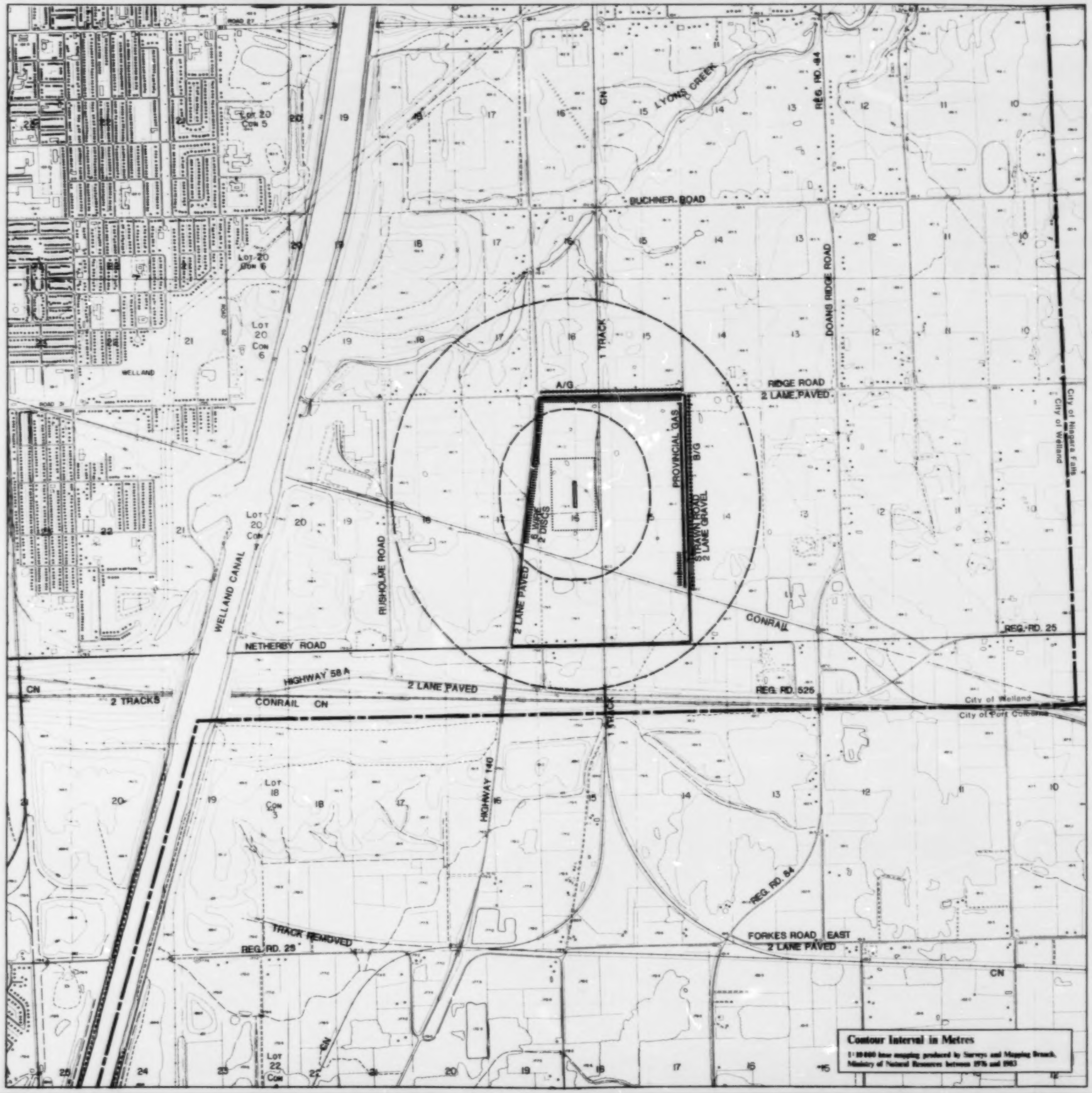
Lots 1, 2, 3 and 4; Concession I; City of Niagara Falls, formerly Township of Crowland


St. Catharines
Niagara Falls
Bismarck
Fonthill
Welland
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984 **MAP DT-33**


WELLAND CANAL
WELLAND
LOT 20 CON 5
LOT 20 CON 6
LOT 20 CON 7
LOT 18 CON 3
LOT 22 CON
LYONS CREEK
CN
REG. RD. 84
BUCHNER ROAD
DOANS RIDGE ROAD
RIDGE ROAD 2 LANE PAVED
A/G
B/G
1 TRACK
6 WIRE 2 DISCS
PROVINCIAL GAS
STRAWN ROAD 2 LANE GRAVEL
2 LANE PAVED
RUSHOLME ROAD
CONRAIL
REG. RD. 25
NETHERBY ROAD
HIGHWAY 58A
2 LANE PAVED
2 TRACKS
CONRAIL CN
REG. RD. 525
City of Welland
City of Port Colborne
City of Niagara Falls
HIGHWAY 140
REG. RD. 84
TRACK REMOVED
REG. RD. 29
FORKES ROAD EAST 2 LANE PAVED

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

OWMC Ontario Waste Management Corporation

Consultant:

DILLON Consulting Engineers & Planners

Legend:

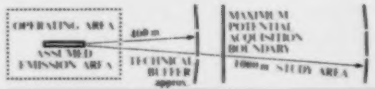
┈┈ Hydro Line

—— Pipeline

┈┈ Telephone Line

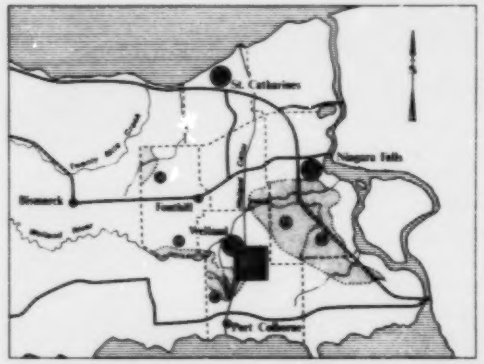
A/G ~ Above Ground

B/G ~ Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400 m
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000 m STUDY AREA

Key Map: **PI-18 East**

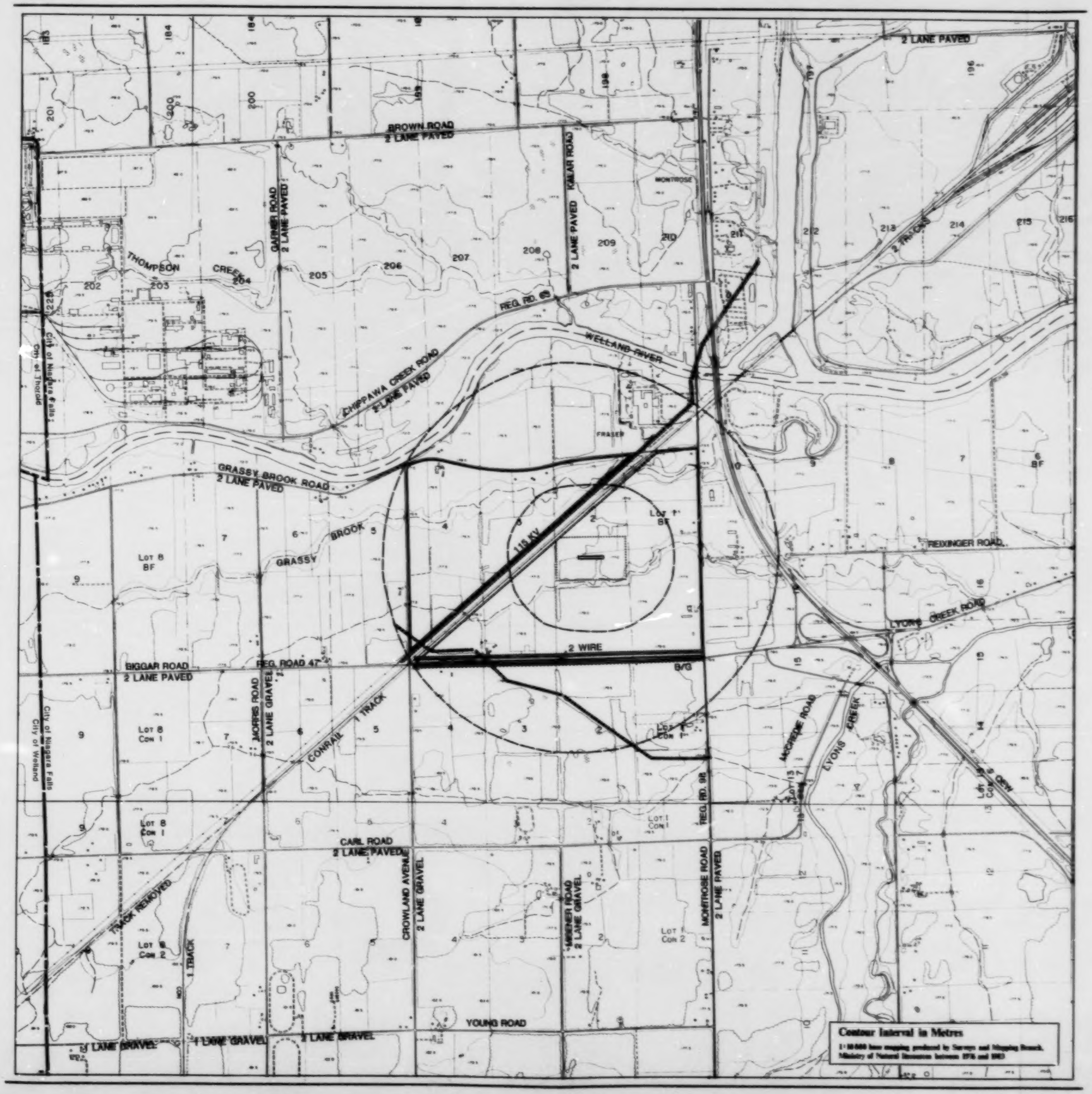
Lots 15, 16 and Part of Lot 17; Concession VII; City of Welland, formerly in the Township of Crowland


St. Catharines
Niagara Falls
Fonthill
Welland
Port Colborne

1000 feet 0 1000
500 metres 0 500

Transportation Factors
CANDIDATE SITE IDENTIFICATION

October 1984 **MAP DT-34**


2 LANE PAVED
BROWN ROAD
2 LANE PAVED
GARNER ROAD
2 LANE PAVED
KALAR ROAD
2 LANE PAVED
MONTROSE
THOMPSON
CREEK
REG. RD. 69
WELLAND RIVER
CHIPPAWA CREEK ROAD
2 LANE PAVED
FRASER
GRASSY BROOK ROAD
2 LANE PAVED
GRASSY
BROOK
115 KV
Lot 1
BF
Lot 8
BF
REIXINGER ROAD
LYONS CREEK ROAD
2 WIRE
B/G
BIGGAR ROAD
2 LANE PAVED
REG. ROAD 47
MORRIS ROAD
2 LANE GRAVEL
CONRAIL 1 TRACK
Lot 8
Con 1
Lot 1
Con 1
MCCREDIE ROAD
LYONS CREEK
REG. RD. 98
City of Niagara Falls
City of Thorold
City of Niagara Falls
City of Welland
CARL ROAD
2 LANE PAVED
CROWLAND AVENUE
2 LANE GRAVEL
MISENER ROAD
2 LANE GRAVEL
MONTROSE ROAD
2 LANE PAVED
TRACK REMOVED
1 TRACK
Lot 8
Con 2
Lot 1
Con 2
YOUNG ROAD
1 LANE GRAVEL
1 LANE GRAVEL
1 LANE GRAVEL
2 TRACKS
Q.E.W.
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216

Contour Interval in Metres

1:10 000 base mapping produced by Surveys and Mapping Branch, Ministry of Natural Resources between 1976 and 1983

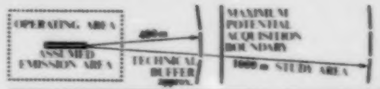
OWMC Ontario Waste Management Corporation

Consultant:

DILLON Consulting Engineers & Planners

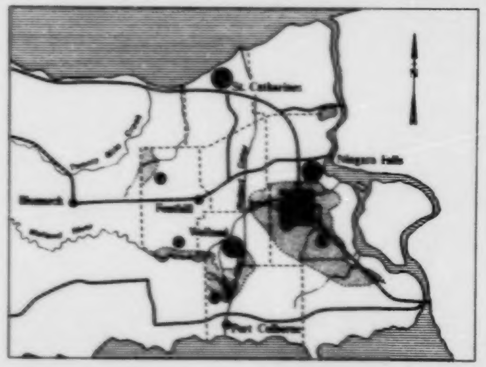
Legend:

Hydro Line
Pipeline
Telephone Line
A/G – Above Ground
B/G – Below Ground


OPERATING AREA
ASSUMED EMISSION AREA
400m
TECHNICAL BUFFER approx.
MAXIMUM POTENTIAL ACQUISITION BOUNDARY
1000 m STUDY AREA

Key Map: **PI - 27 East**

Part of Lots 1, 2, 3, and 4; Broken Front Concession Welland River; City of Niagara Falls; formerly in the Township of Crowland


N
St. Catharines
Niagara Falls
Welland
Port Colborne

1000 feet
0
1000
500 metres
0
500

Transportation Factors CANDIDATE SITE IDENTIFICATION

October 1984

MAP DT-35

APPENDIX I

CALCULATIONS OF CEMENT ADDITIVE QUANTITIES FOR 150,000 TONNE WASTE STREAM SCENARIO

JUL 17 1984
M. M. DILLON LTD.
TORONTO OFFICE

FROM: W. I. Walker (M.M.Dillon Ltd.)

RE: OWMC Phase 3, Calculation of Cement
Additive Quantities for 150,000 Tonne
Waste Stream Scenario

DATE: 13 July 1984

The quantities of cement and flyash calculated for the transportation cost study done in December 1983 are based on the material balances developed in the 5 October 1983 memorandum entitled "Preliminary Process Design Review and Engineered Landfill Sizing". The balances presented in Tables IV and V for the cement/flyash process (Coded C/F) are based on an additive ratio of 2.05:1. The internal ratio of cement to flyash is 1:3 as per design data obtained for a cement/flyash process and published Table VIII of Appendix II of a memorandum entitled "Raw Waste Data" dated 13 September 1983.

The latter data also shows that the additive ratio of 2.05:1 (which originates from work by P. Cote for the National Research Council) is far above the typical plant design. Laboratory work on the cement/flyash process confirmed that additive ratios in the range of 0.3:1 to 1.0:1 were more appropriate for use in calculations. It is the latter range that was used in the December work on transportation costs.

The transportation study addressed a matrix of cases involving a variety of plant arrangements and processing options. Without reference to the arrangement options, the processing options were as follows:

Waste quantity:	150,000 t/a 300,000 t/a 500,000 t/a
Solidification process:	Cement/flyash
Additive ratios:	0.3:1 1.0:1

Implicit in the calculations is the assumption that the foundry sand (OWMC Category 11, UCD Class 151) can take the place of flyash since both act to supply silica to the solidification process. In addition, the incinerator ash was considered to be usable in place of coal-generated flyash.

Given the above assumptions, the procedure followed was to calculate the additives required on the basis of the total waste to solidification less the foundry sand and the incinerator ash. The required flyash portion of this figure was then compared to the available amount of foundry sand and incinerator ash. If the amount of foundry sand and incinerator ash was in excess, then additional cement was added to provide for solidification of this material.

At an additive ratio of 0.3:1, the available amount of foundry sand and incinerator ash is consistently in excess of that required and additional cement is necessary.

At an additive ratio of 1.0:1, the situation is reversed and additional flyash is required to make up the full amount of additives required.

It should be noted that this is the least expensive option. In the other extreme, one would assume that both the foundry sand and the incinerator ash were wastes and would add the appropriate amounts of cement and flyash to solidify them. This could mean an increase of up to 50 per cent in solidified volume.

The cement source was chosen as Ingersoll since, given the relative locations of the sites considered in the study, this appeared to be essentially neutral from a transportation viewpoint. The whole Ingersoll/Beachville/Woodsock area can be considered as one source. Other sources would include St. Marys and Bowmanville, but neither of these were considered to be as neutral as the one chosen.

Attachments Tables IV & V

TABLE IV

PARTIAL SOLIDIFICATION OPTION
SOLIDIFICATION PLANT MATERIAL BALANCE
(500,000 t/a Waste Case)

Waste Inputs

Physical Chemical Plant Output	
- Waste	150 140 t/a
- Reagents	20 000 t/a
- Treated Scrubber B/D	21 600 t/a
- Aqueous Effluent	119 300 t/a
Total Input to Solidification	170 140 t/a
Direct Solids Input	91 800 t/a
Incinerator Ash	19 530 t/a
Total Inerts	111 330 t/a

Additives

CKD Process Additives	
- Gross	425 350 t/a
- Net*	314 020 t/a
C/F Process Additives	
- Gross	348 790 t/a
- Net*	237 460 t/a

Outputs

Total Solidification Product	
- CKD	595 490 t/a
- C/F	518 930 t/a
Solidified Product Volume	
- CKD	425 350 m^3/a
- C/F	326 370 m^3/a
Aqueous Effluent	
- To Incinerator	34 000 t/a
- To Receiving Stream	106 900 t/a

*Net figure is gross less total inerts.

TABLE V

TOTAL SOLIDIFICATION OPTION
SOLIDIFICATION PLANT MATERIAL BALANCE
(500,000 t/a Waste Case)

Waste Inputs to Solidification	
Physical Chemical Plant Output	
- Waste	150 140 t/a
- Reagents	20 000 t/a
- Water to Incinerator	34 000 t/a
- Water to Solidification	85 300 t/a
Incinerator Scrubber B/D	21 600 t/a
Total Aqueous Effluent	106 900 t/a
Total Input to Solidification	277 040 t/a
Direct Solids Input	91 800 t/a
Incinerator Ash	19 530 t/a
Total Inerts	111 330 t/a
Additives	
CKS Process Additives	
- Gross	692 600 t/a
- Net*	581 270 t/a
C/F Process Additives	
- Gross	567 930 t/a
- Net*	456 600 t/a
Outputs	
Total Solidified Product	
- CKD	969 640 t/a
- C/F	844 970 t/a
Solidified Product Volume	
- CKD	692 600 m^3/a
- C/F	531 400 m^3/a

*Net figure is gross less total inerts.

APPENDIX J

TRANSPORTATION ACCESSIBILITY INDICATORS FOR ROUTES ACCESSING GOOD HYDROGEOLOGICAL AREAS

TABLE J-1
TRANSPORTATION ACCESSIBILITY INDICATORS FOR ROUTES ACCESSING GOOD HYDROGEOLOGICAL AREAS

ROUTE NO.	DISTACE FROM QEW (km)	ACCIDENT RATE (ACCIDENTS/MILLION-VEHICLES)
1	20.5	50.25
2	28.2	83.28
3	24.1	85.47
4	21.2	86.31
5	19.2	67.23
6	25.2	79.37

POOR

QUALITY

ORIGINAL